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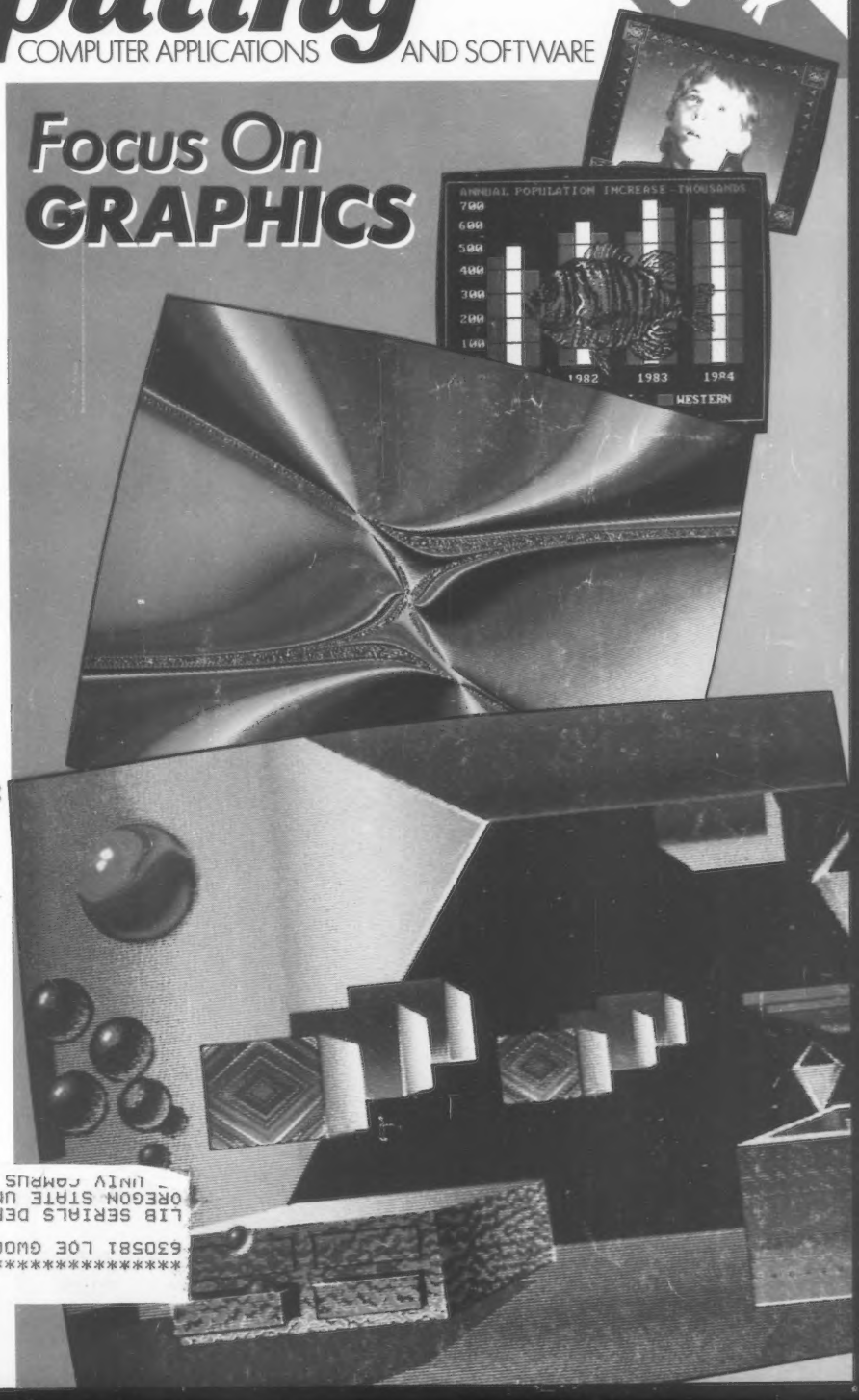

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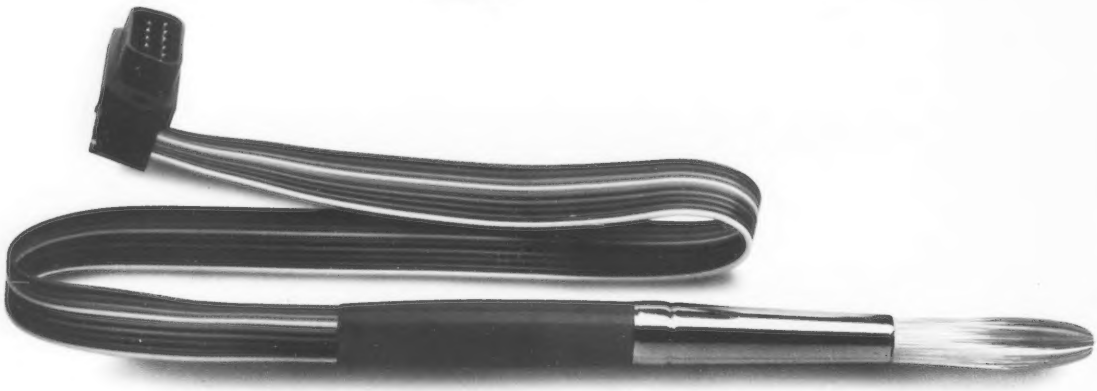

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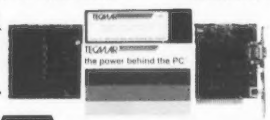

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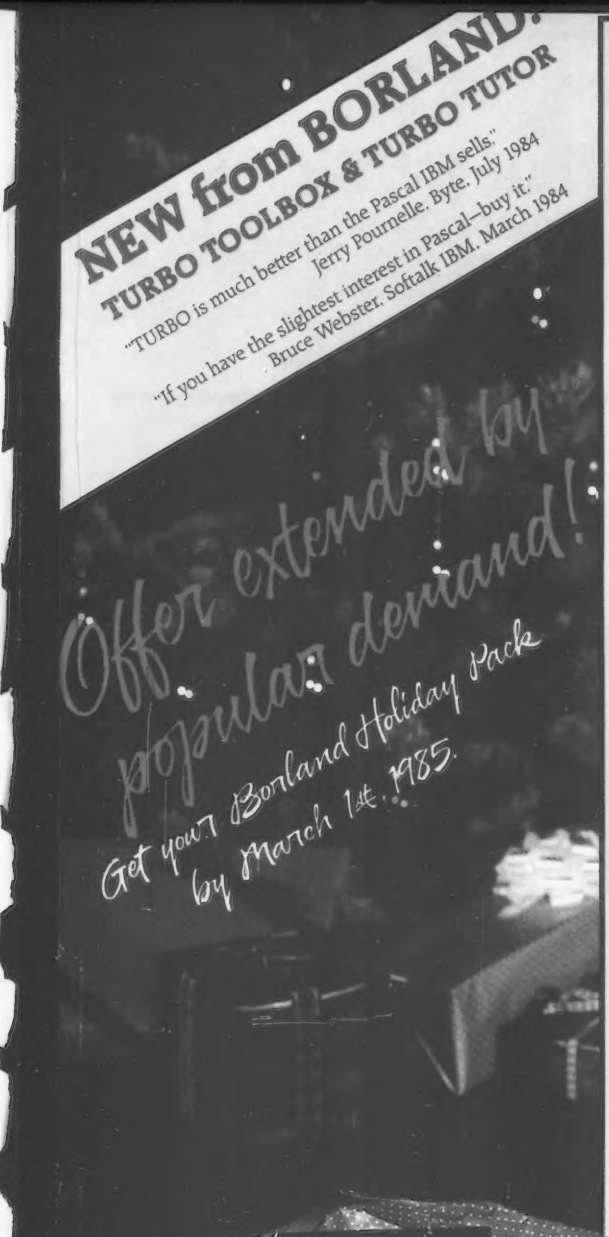
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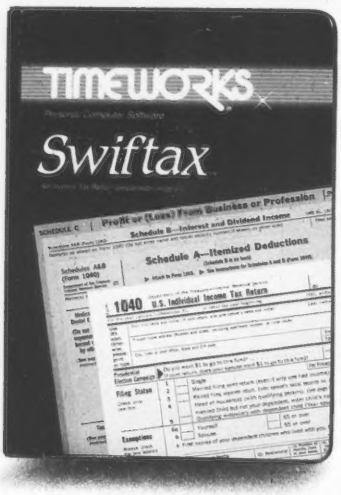

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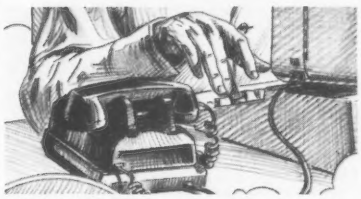

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Cover credits (top to bottom): Screens 1, 2, and 4 created with Lumena Graphics System. Copyright 1985 Time Arts Inc. A review of a subset Lumena system for the Mindset computer appears on page 52. Cover screens were created with the ultra hi-res Tesserac frame-buffered Lumena System. We will devote a feature review to this system in an upcoming issue. Screen 3 was created on an Apple II running a Vectrix 384 graphics system. The image is a plot of a three-dimensional function, inspired by an article in the December 1978 issue of *Creative Computing*. Copyright 1985 Applied Analytics Inc.

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INPUT/ OUTPUT

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Dear Editor:

I am writing in response to your October review of the Apple version of our product, Kids On Keys.

You are absolutely right. The version your reviewer, Penny Smith, used was far too difficult for the intended age group for the program, kids aged 3 to 9. The problem was identified by our staff two months ago and has been corrected. The corrected version is now available in stores across the country.

Consumers who have purchased the old, faulty version can send that disk to our customer service department and we will be happy to send them a new disk free of charge.

William H. Bowman, Chairman
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Tricks and Treats

Dear Editor:

Thank you for the tenth anniversary issue of *Creative Computing*. I saw myself in several of the now successful people who started large companies with little more than dreams—especially in the story of Forrest Mims parking cars with an engineering degree.

I'd like to offer a prediction for the future of computing. The twentieth anniversary issue of *Creative Computing* will contain an article by a computer snob—some kid now in high school learning Basic, who will state that to be a *real* computer, a machine must have 30Mb of memory, voice recognition, a 64-bit address bus, and artificial intelligence in ROM.

I also predict that the public will swallow the AI myth hook, line, and sinker, and fail to realize that AI is based on the same kind of magic used by Blackstone and Edger Bergen. (The difference between Blackstone and today's computer science magicians is that Blackstone knew that it was only a sophisticated trick!)

Steve McGrew
RAM-BAM Arts & Games
617 Constitution Dr.
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Selectricity

Dear Editor:

In one area of history, your publication has been deficient. I happen to be a strong fan of standard electric typewriter keyboard layouts for computers. However, I cringe when I read, for the umpteenth time, "why didn't IBM use its Selectric keyboard on the IBM PC."

For starters, the standard arrangement of keys on an electric typewriter (¢ over 6, * over 8) existed before IBM introduced the first Selectric typewriter back in 1961. In fact, it wasn't until the Selectric II that the IBM Selectric conformed to the standard completely, by placing the exclamation point over the numeral 1.

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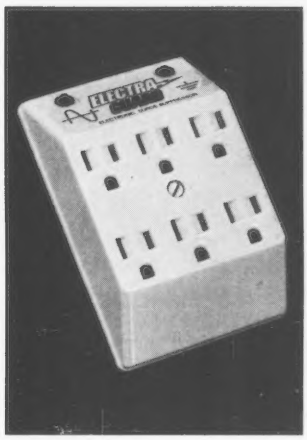

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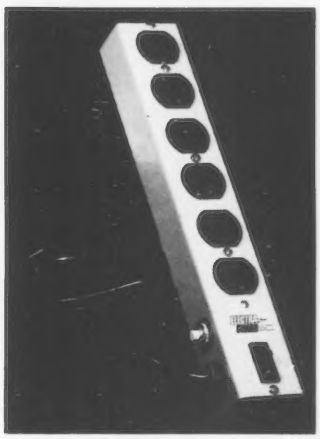

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course, when it came out, the IBM PC.

So, we don't have one unaccountable stupidity on IBM's part, but instead a series of little mistakes, each one of which seemed reasonable at the time.

John Savard
#1, 10737-116th St.
Edmonton, AL
T5H 3M3

Eei Ee I/O

Dear Editor:

For the past few days, I have been thumbing through your excellent magazine, admiring the interesting articles and drooling over the ads. You are to be congratulated for making an excellent magazine fly for ten years.

I have decided to start a user's group for farmers using computers. This would give farmers and agribusinessmen a means of exchanging information and a means by which newcomers in the farm computer field could get help with special problems that more experienced farm computer operators might already have overcome.

I would welcome correspondence from readers who might be interested.

Kelly Klaas
K-K Land & Livestock
Rt. 1 Box 4133
Twin Falls, ID 83301

NOTICES

Let Us Do The Typing

Many of the programs that appear in *Creative Computing* are available for direct downloading from the Creative Computing Special Interest Group (SIG) on CompuServe. In addition, the SIG features a public bulletin board, "mailboxes" for each of the regular columnists, a street price index, and regularly scheduled rap sessions with editors and contributors. To get the SIG quickly once you are logged on, simply type GO PCS 22 at any prompt.

Reach An Editor Quickly

Want to reach Betsy Staples, John Anderson, Dave Ahl, or another editor in a hurry? You can do so via MCI Mail. Send to BSTAPLES or account number 257-0077.

Innovative Educational Applications

A national conference, "Innovative Microcomputer Applications in School Programs" will be held March 31—April 2, 1985 at the Baltimore Plaza Hotel in Baltimore, MD. The program is designed for computer studies directors, K-12 teachers, and administrators. For information, contact Melinda Curtis, Friends School, 5114 N. Charles St., Baltimore, MD 21210. (301) 435-2800.

ACT Apricot Address

Since we ran our reviews and previews of the ACT product line, the company has moved to new quarters. You can contact them at ACT Computers, Inc., 3375 Scott Blvd., Suite 342, Santa Clara, CA 95954, (408) 727-8090.

Free Computer Handbook

Trends in Information Technology: 1985 is an excellent 80-page handbook for executives and others who want a grounding in the effects of computers—technological, social, and economic—as well as trends in information systems, network architecture, and system development. The book closes with a series of specific (and pragmatic) action recommendations for the coming year. The book is free from your local Arthur Anderson & Co. office, or write Arthur Arthur Anderson & Co., 69 W. Washington St., Chicago, IL 60602.

New Address for Hope Center

The current address for the Hope Center "Hands Off Program Experience" (see "Of Passion and Pet Projects" by Peter McWilliams, Nov. 1984) is Hope Center, Attn: Gerry Schwartz, c/o Voice Prints, Inc., P.O. Box 16171, Irvine, CA 92713, (714) 756-9099.

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Presenting the software package that makes your computer more productive and cost-efficient.

CompuServe's new Vidtex™ is compatible with many personal computers sold today (including Apple,® Commodore® and Tandy/Radio Shack® brands). And it offers the following features*–and more–to let you communicate more economically with most time-sharing services (including CompuServe's Information Service).

Auto-Logon. Lets you log on to a host simply and quickly by utilizing prompts and responses defined by you. Also allows quick transmission of predefined responses to host application programs after logging on.

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Full Printer Support. Printer buffer automatically buffers characters until printer can process; automatically stops on-line transmission when full; and automatically resumes transmission when capacity is re-established. Also, lets you print contents of textual video screen or RAM buffer at any time.

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On-line Graphics. Integral graphics protocol displays stock charts, weather maps and more.

If you are already a CompuServe subscriber, you can order Vidtex on line by using the GO ORDER command. Otherwise, check with your nearest computer dealer; or to order direct, call or write:

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*Some versions of the Vidtex software do not implement all features listed.

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Introducing the most powerful

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Hold on to your hat.

The new IBM Personal Computer AT (for Advanced Technology) is based on the advanced 80286 16-bit microprocessor. This remarkable computer will run many of the programs written for the IBM PC, up to three times faster. You'll be able to recalculate large spreadsheets in seconds and retrieve files in a flash.

It's got the power (and price) to surprise you. In many ways.

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With the IBM Disk Operating System, the IBM Personal Computer AT can use many programs from the fastest-growing library in the personal computer software industry.

The IBM Personal Computer AT is also available with up to 3 million bytes of user memory to run multiuser, multitasking operating systems such as XENIX™. Volume upon volume of information is available at your fingertips. You can customize your system to store up to 20,000 pages of information at one time. And its keyboard helps you use all of this computing power more easily.

This new member of the IBM PC Family is a powerful stand-alone computer that can also be both the primary file server and a station on your network. With the new IBM PC Network (which is so easy to connect you can do it yourself), the

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Printers
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INDUSTRY INSIDER

David H. Ahl

Red Ink and Layoffs

Latest casualities in the personal computer market: **Otrona Advanced Systems**, maker of a transportable IBM clone. The company plans to liquidate rather than try to reorganize under the protection of Chapter 11. **Franklin Computer**, now operating under Chapter 11, has been unable to find a buyer or merger partner, and also plans to liquidate.

In 1973, Archie McGill, the youngest vice president of IBM, left for the greener pastures of AT&T. Eight years later, the feisty McGill departed AT&T to assume the presidency of Rothschild Ventures, a venture capital firm. A major venture, of which McGill became chairman, was **Knoware, Inc.** of Cambridge, MA. The company, founded by two MIT professors, marketed a software package that purported to teach executives how to climb the corporate ladder by learning to use their personal computers. Purchasers weren't convinced, and after many months of going nowhere, the firm is now in liquidation.

At the Softcon show last year, **Ovation** was touting a new integrated software package. "It will run rings around *Symphony* and *Framework*," said enthusiastic booth personnel. But the product was plagued by delay after delay. Today, the firm is for sale. Ever optimistic, President Thomas Gregory hopes someday to see the product on the market.

Handwriting on the wall? Last June, Rodnay Zaks of **Sybex Computer Books** invited 20 notable computing pioneers for Pioneer Days in San Francisco. It was a gala media event. Then, three months later, each pioneer received a letter from the credit manager of the Hyatt Regency which said, "Sybex has not paid for your account and your charges have been placed on your personal credit card." Pretty shabby, Sybex.

CDs Invade Computer Field; Floppies Retaliate

Four leaders in audio company disc technology, **Denon, Philips, Sony** and **3M**, have announced the development of a CD-based optical read only memory (ROM) system for computers. A single 4 3/4"CD-ROM has a capacity of over 550Mb, about the equivalent of 500 double density floppy disks. In addition to offering efficient storage, this enormous capacity also provides the opportunity to store high-resolution graphics along with standard ASCII data.

* * * * *

Information Storage of Colorado Springs has introduced a 5 1/4" 100 Mb, write-once optical disk drive. The medium is supplied by Hitachi/Maxell and Sumitomo Chemical and is seen as a first move into the U.S. market by Sumitomo.

Evaluation units are priced at $3000; however, company president Steve Popovich expects prices to drop to $500 by 1986. Popovich feels the drive will satisfy "a real need for archival and audit trail data."

"Record Album" Diskettes

Memron, a San Jose floppy disk maker, has developed a process, Chromadisk, to print full-color images directly onto a diskette carrier. Says Bill Bollinger of Memron, "Of course it's not fair to judge a word processing package, spreadsheet, or educational program by the way it looks. Nevertheless," he added, "people will always tend to judge a book by its cover."

A secondary benefit of printed diskette carriers is prevention of commercial piracy; dishonest stores will have a difficult time selling a black copy of a disk that should be printed.

Random Bits

We hear from Japan that **IBM** ordered upwards of one million 3.5" microfloppy drives from Toshiba and Alps. For what you might ask? A new portable, perhaps? . . . **IBM** also bought a bunch of Japanese MSX computers, peripherals, and software from Qest Publishing, a group of former SpectraVideo employees.

Microsoft has developed a new operating system, HH-DOS (hand held DOS), which integrates common applications of notebook computers and is file compatible with MS-DOS . . . On the other hand, an apologetic letter from Vice President Steve Ballmer of **Microsoft** discloses a further delay in the shipment of Microsoft *Windows* from November 1984 to June 1985. Apparently the designers are having problems with speed, graphics capabilities, and reliability . . . Microsoft isn't alone. Gordon Mustain of **Rising Star** announced yet another delay in the release of Valdocs 2.0 for the Epson QX-10 to increase the speed of the word processing module and add additional features . . . And speaking of **Epson**, they recently proposed a standard coding scheme for printers called ESC/P. It seems sensible to us and perhaps with 40% of the dot-matrix printer market, Epson can make it happen.

Having lost $3 million in the first nine months of 1984, **Management Science America** (MSA) has put **Peachtree Software** up for sale. So far, no takers. Peachtree recently bought two educational software publishers, **Edu-Ware** and **Design Ware** but killed off the Edu-Ware label. Now, Design Ware plans to re-introduce the label . . . Sherwin Steffin, founder of Edu-Ware, has filed an $11.6 million suit against MSA alleging securities fraud, conspiracy, and violation of agreements related to the acquisition. He claims that MSA deliberately depressed Edu-Ware sales after the acquisition was completed in order to diminish payments to Edu-Ware shareholders.

Doubleday paid one of the biggest advances ever for a computer book, $1.3 million, to Stewart Brand for the *Whole Earth Software Catalog*. To make money on the deal, Stewart figures Doubleday will have to sell more than 500,000 copies. *Infoworld* is betting they do it; I'll be surprised if they touch 100,000.

Troubled **VisiCorp** will merge with a new Sunnyvale-based company, **Paladin**. Founders Dan Fylstra and Peter Jennings will not have a role in the new company . . . We hear that **Apple** will discontinue the Lisa line in 1985 and concentrate on the larger Macs. After discussing the 16-bit Apple IIx on Compuserve, Steve Wozniak now denies any plans for it at all . . . In early November 1984, **Apple** built its two millionth Apple II. ■

HELP YOUR CHILD GRASP DIFFICULT SUBJECTS

Parents who help with homework know how tough it is to be in school these days. Even kids at the head of the class need all the help they can get, and sometimes parents do too! DesignWare family learning games provide motivating and interactive ways to enrich your child's education at home.

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DesignWare programs blend teaching and fun to keep the fun in learning. They're quick and responsive, providing immediate feedback and reinforcement. Built-in demonstrations and liberal use of graphics, sound and *on-screen help* make them fast, easy and fun—even the first time you use them.

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DesignWare programs cover "core" subjects and basic skills—and are tested by full-time teachers, parents and hundreds of children like your own. Some are award winners: MATH MAZE,™ SPELLAGRAPH,™ CRYPTO CUBE™ and TRAP-A-ZOID.™ Or try our latest bestsellers—SPELLICOPTER,™ STATES & TRAITS™ and THE GRAMMAR EXAMINER.™

STATES & TRAITS (ages 9 to adult) covers U.S. geography, land forms, related trivia, and *where* history took place. It can be expanded to cover current studies, family history and other topics.

As a reporter on "THE GRAMMAR EXAMINER" (ages 10 to adult), you learn grammar skills by editing hundreds of humorous news stories, writing your own grammar problems into stories, playing on four different game boards, or creating new game boards of your own.

MISSION: ALGEBRA™ (ages 13 to 18) generates thousands of equations. Solving each group of equations helps rescue a stricken space ship. The computer instantly checks each step in your solution, no matter what approach you use, and can coach you when you run into trouble.

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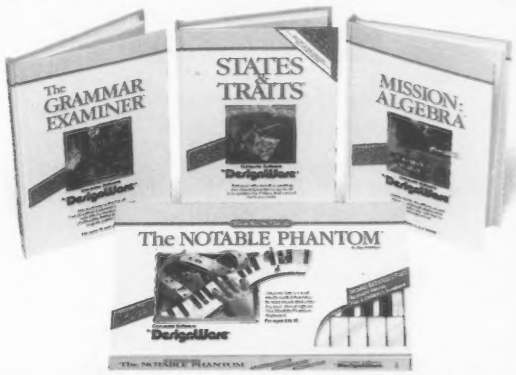
DesignWare family learning games are available at all major software retailers, and run on Apple II family, IBM PC, PCjr, Commodore 64, Atari and other popular microcomputers with disk drives. We provide a 90-day warranty against defects and free telephone support.

Our latest releases come in easy-to-preview, easy-to-read hardcover books, which also provide permanent disk storage. Visit your local software retailer or write for our free catalog. DesignWare, Inc., Department MC, 185 Berry Street, San Francisco, CA. 94107.

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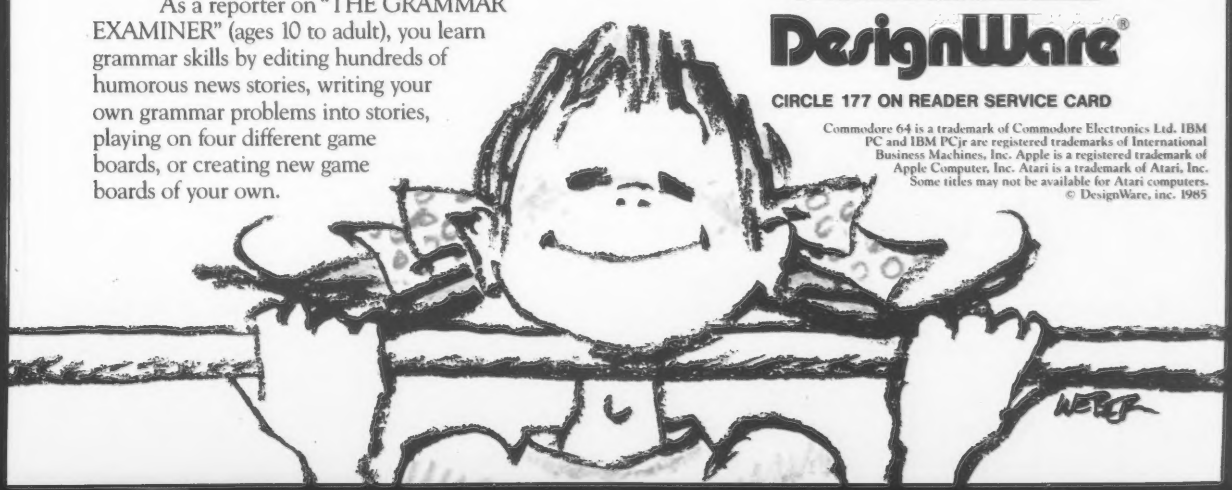

BOOK REVIEWS

Graphics, telecommunications, Macintosh

Russ Lockwood

Commodore 64 Sight & Sound by John J. Anderson. Creative Computing Press, 39 East Hanover Ave., Morris Plains, NJ 07950. Softcover, 136 pages, $12.95

Commodore 64 Sight & Sound provides tips and tricks on using Basic to program graphics and sound routines on the Commodore 64. The tutorials, backed by program listings, offer theoretical and practical information for beginning and advanced programmers.

The book starts with general information on setting up the Commodore 64, including obtaining the best possible picture, operating a disk drive, and learning the idiosyncrasies of the keyboard. It moves quickly into a command-by-command explanation of Basic in ROM.

A thorough explanation of Simon's Basic, an inexpensive extension of Basic with special graphics and sound commands, takes up the bulk of the book. A discussion of sprite graphics and examination of sound effects round out the book.

John Anderson, no stranger to readers of *Creative Computing*, offers an excellent tutorial for Commodore 64 programmers. *Commodore 64 Sight & Sound* provides an extensive array of tips, tricks, and techniques to help the programmer wring the most graphics and sound effects out of Basic, Simon's Basic, and the Commodore 64.

Ken Uston's Illustrated Guides by Ken Uston. Prentice Hall, Englewood Cliffs, NJ 07062. Softcover, 250 pages, $9.95

Ken Uston, infamous blackjack and Pac-Man player, has written a series of books for the total computer neophyte. The guides are currently available for the Macintosh, Commodore 64, Apple IIe, IBM PC, Kaypro, Compaq, and Coleco Adam. We promise to keep our search and replace jokes to a minimum.

Seriously, each book presents an overview of the particular computer, and perhaps more important, provides a quick tutorial on related programs. While we can nitpick about learning Basic programming in 15 minutes or designing a spreadsheet in 30 minutes, we think the books address questions and problems confronting first-time computer users.

The books generally divide into five major sections: system purchase and set-up, word processing, calculating and spreadsheets, telecommunications, and games and programming.

1985 Computer User's Desk Diary by Gil Roeder and Jasno A. Shulman. Workman Publishing, 1 West 39th St., New York, NY 10018. Softcover, 126 pages, $8.95

This desk calendar contains fascinating anecdotes, notable dates, and other tidbits about computers and the pioneers in the electronics industry. Photographs of the pioneers and machines and computer generated art color the pages.

The information within is very complete. For example, the entry for May 17 reads "David Ahl, editor/publisher of *Creative Computing*, is born in 1939." Birthday cards will be appreciated.

The Computer Data and Database Source Book by Matthew Lesko. Avon Books, 1790 Broadway, New York, NY 10019. Softcover, 980 pages, $14.95

Telecommunications puts a world of information at your fingertips. The problem is finding the right service. Well, search no longer. *The Computer Data and Database Source Book* contains more services than you can shake a modem at.

The book lists and describes commercial, government, and public databases. Each individual database is defined by subject, source, content, date of information, producer, producer address and phone number, availability, cost, and restrictions.

Note that the section dealing with public databases covers mostly printed matter, although it also details purchasing computer tapes and contacting a "data expert." The book ends with a few pages of advice on obtaining data under the Freedom of Information Act.

Matthew Lesko, who authored *Information USA*, has compiled another definitive tome for the information-hungry consumer.

Using & Programming the Macintosh Including 32 Ready-to-Run Programs by Frederick Holtz. Tab Books, Blue Ridge Summit, PA 17214. Softcover, 243 pages, $12.50

This book receives our nomination for the longest title around. It also receives our nod as a good introductory book for Macintosh owners.

Although at times sounding like a rewrite of the manuals, a common ailment of many Macintosh books, the chapters on *MacWrite* and *MacPaint* provide enough information to get you started producing drawings and text. Two other chapters discuss the Finder, a part of DOS that serves as a control link for file management.

Far better are the four chapters on learning Microsoft Basic and programming the mouse.

The 32 programs prove less helpful than we had hoped, although some graphics patterns are interesting and the Alphabetizer can come in handy. However, part of the appeal of the book is that beginners can alter the programs to suit their needs.

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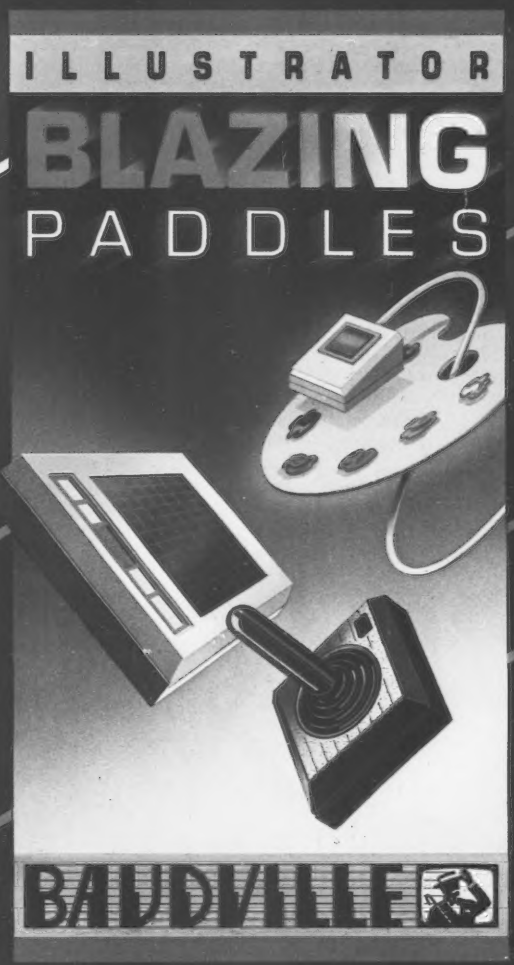

Sophisticated Features

State-of-the-Art input technology, color mixing to create over 200 textured hues, painting with a variety of brush strokes, air-brushing, inserting ovals, lines, rectangles. Zoom allows pixel editing while viewing the results at full scale. Text fonts and pre-drawn shapes are included and may be added at any time. A printer dump for most dot matrix printers is included.

Productive Fun

Includes all the artistic tools needed to create striking computer art. So versatile that young children are able to use it like a coloring book, yet sophisticated enough for a computer artist to use. Perfect for Home, Business, Education, and the Art. The possibilities are endless...

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BOOK BRIEFS

Graphics

Computer Animation Primer by David Fox and Mitchell Waite. McGraw-Hill, 1221 Avenue of the Americas, New York, NY 10020. Softcover, 501 pages, $22.95

The book describes how to use Atari Basic and machine language routines to create graphics and animation. It is profusely illustrated with photographs, drawings, and program listings.

Commodore 64 Graphics & Sound Programming by Stan Krute. Tab Books, Blue Ridge Summit, PA 17214. Softcover, 240 pages, $15.50

Written for the intermediate-level programmer, this handbook covers defining and using sprite, character, and bit-mapped graphics and sound effects. It includes tips, tricks, and 68 Basic programs.

Computer Graphics and Applications by Dennis Harris. Chapman and Hall, 733 Third Ave., New York, NY 10017. Softcover, 174 pages, $19.95

This British import introduces the principles and uses of computer graphics to the computer professional. It describes hardware and software and discusses applications in art, animation, business, chemistry, and defense.

Computer Graphics Glossary by Stuart W. Hubbard. Van Nostrand Reinhold, 135 West 50th St., New York, NY 10020. Softcover, 95 pages, $15.50

The book is a glossary of terms used in Computer Aided Design and Computer Aided Manufacturing.

The IBM PCjr Image Maker by Jonathan Erickson and William D. Cramer. Osborne McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710. Softcover, 312 pages, $14.95

This guide to programming graphics in Advanced Basic on an enhanced IBM PCjr guides the user in creating pie charts, graphs, animation, and three-dimensional drawings.

PC Graphics by Dick Conklin. John Wiley & Sons, 605 Third Ave., New York, NY 10158. Softcover, 182 pages, $15.95

The book helps Basic programmers generate pictures, charts, and graphs, and computer art on the IBM PC. It covers hardware and software options, medium-and high-resolution graphics, programming tips, and special applications using lightpens.

Telecommunications

Answers Online by Barbara Newlin. Osborne McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710. Softcover, 384 pages, $16.95

Extensive reference manual covering telecommunications provides detailed information on hundreds of on-line databases.

C-64 Telecommunications by Jonathan Erickson. Osborne McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710. Softcover, 186 pages, $14.95.

Introductory book discusses telecommunications using the Commodore 64. It includes information on hardware,

Wizard of ease.

Easy user.

Letter Wizard is an ideal word processing program for even the most serious wordsmith in your family. It boasts a spelling checker, built-in database manager and compatibility with all popular printers. Nice thing is, commands are a whiz to learn and perform.

Easy writer.

Compose and edit right on the screen. At the stroke of a key, you can move, delete, insert, search and replace words and paragraphs like. . .well, magic.

Easy speller.

Letter Wizard includes a spelling checker which allows easy in-line corrections of over 33,000 words. And you can even create custom dictionaries of your own special words. Have we got you under our spell yet?

Easy buyer.

OK, a powerful program like this must cost a powerful lot of money, right? Stuff and nonsense. Even though Letter Wizard offers more than most, it costs less than most. And that's no voodoo.

For Commodore 64, Apple II and Atari systems.

Letter Wizard™ with Spelling Checker by Datasoft®

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software, services, and bulletin boards.

The Joy of Computer Communication by William J. Cook. Dell Publishing, 1 Dag Hammarskjold Plaza, New York, NY 10017. Softcover, 182 pages, $5.95

Flighty introduction to telecommunications potential and actual on-line exploits of author. It touches on some offerings of major services with a lot of style but little substance.

On-line Guide for the Commodore Computers by Mike Cane. New American Library, 1633 Broadway, New York, NY 10019. Softcover, 377 pages, $9.95

This guide examines telecommunications for the Commodore 64 and Vic 20 owner. It covers hardware, software, major on-line services, and bulletin boards.

Macintosh

Apple Macintosh User's Handbook by Weber Systems Staff. Ballentine Books, 201 East 50th St., New York, NY 10022. Softcover, 322 pages, $9.95

An introductory guide provides general information on set-up and operation of *MacPaint, MacWrite* and telecommunications.

Introducing the Macintosh by Charles B. Duff. McGraw-Hill, 1221 Avenue of the Americas, New York, NY 10020. Softcover, 195 pages, $14.95

Another guide to Macintosh hardware and software delves into Quickdraw graphics, User Interface Toolbox, and programming in Basic, Pascal, and Forth.

The Instant Expert's Guide to the Apple Macintosh by John Markoff, Kathy Sullivan, and Lenny Siegel. Dell Publishing, 1 Dag Hammarskjold Plaza, New York, NY 10017. Softcover, 128 pages, $9.95

Introductory buyer's guide for would-be Macintosh owners includes terse tutorials on *MacWrite, MacPaint*, Basic, and telecommunications.

The Macintosh Guide by Paul Stark. Quarto Marketing, 212 Fifth Avenue., New York, NY 10010. Softcover, 128 pages, $9.95

Grab bag introduction of tips, techniques, and uses for *MacWrite, MacPaint*, and Basic.

101 Ways to Use a Macintosh by David D. Thornbury. Random House, 201 East 50th St., New York, NY 10022. Softcover, 364 pages, $14.95

Serious book suggests mostly superfluous tasks for the Macintosh.

Understanding the Macintosh Computer by Rich Dayton. Reston Publishing, Reston, VA 22090. Softcover, 204 pages, $18.95

General introduction to hardware and software covers *MacWrite, MacPaint, MacPlan*, and *MacChart*.

Using MacWrite and MacPaint by Tim Field. Osborne McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710. Softcover, 200 pages, $11.95

Idea book discusses how to use *MacWrite* and *MacPaint* for business applications. ■

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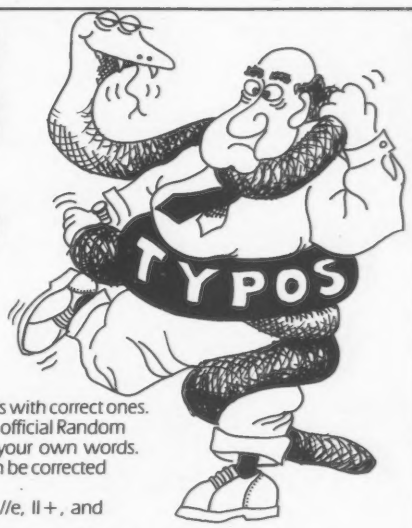

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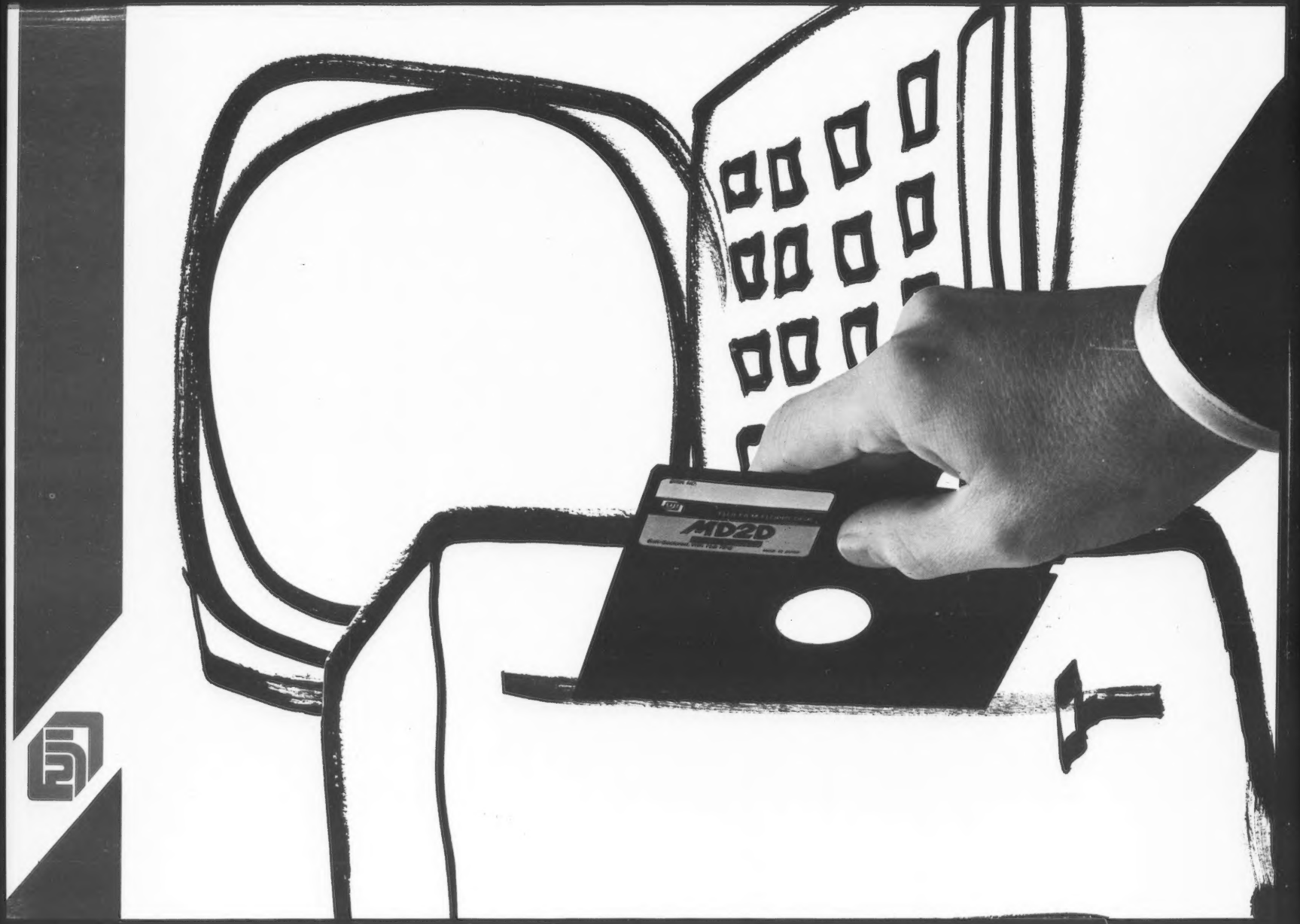
CIRCLE 155 ON READER SERVICE CARD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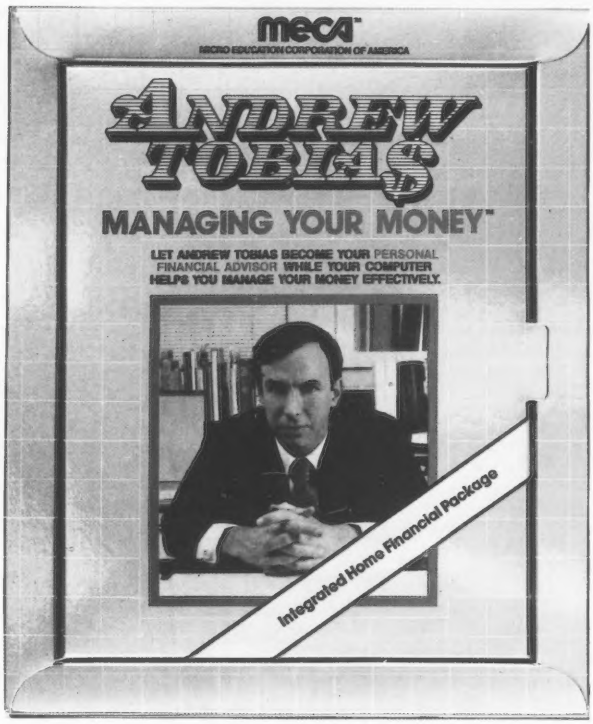
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CIRCLE 224 ON READER SERVICE CARD

Hello Out There!

You have probably noticed some design changes in *Creative Computing* recently. We hope that you agree that the changes in typography and page layout make the magazine more attractive and readable. In editorial content, changes tend to be more evolutionary in nature. However, since our last major reader survey three years ago, some of these changes have been fairly dramatic. Well, what do you think? Are we on the right track? Are we meeting your needs?

We would appreciate it if you would take five minutes to fill out this questionnaire and return it to us. All it will cost you is a few minutes and a 20 cent stamp. In return, we'll be able to bring you a magazine that meets your needs.

Please return the questionnaire (a photo copy is fine) to:

Reader Survey
Creative Computing
39 E. Hanover Ave.
Morris Plains, NJ 07950

I. EDITORIAL CONTENT

1. Please check your reaction to each regular feature:

	Great	Good	Fair	Forget it
Reviews and evaluations of:				
Desktop computers	☐	☐	☐	☐
Portable computers	☐	☐	☐	☐
Home computers	☐	☐	☐	☐
Printers	☐	☐	☐	☐
Other peripherals	☐	☐	☐	☐
Business software	☐	☐	☐	☐
Personal productivity software	☐	☐	☐	☐
Communications software	☐	☐	☐	☐
Educational software	☐	☐	☐	☐
Entertainment software	☐	☐	☐	☐
Books	☐	☐	☐	☐
Departments:				
I/O (Letters to the editor)	☐	☐	☐	☐
Editorial	☐	☐	☐	☐
Notices	☐	☐	☐	☐
Industry Insider	☐	☐	☐	☐
Telecommunications Talk	☐	☐	☐	☐
Profile/People	☐	☐	☐	☐
Apple Cart	☐	☐	☐	☐
IBM Images	☐	☐	☐	☐
Tandy Gram	☐	☐	☐	☐
Commodore's Port	☐	☐	☐	☐
Outpost Atari	☐	☐	☐	☐
Handicapped Computing	☐	☐	☐	☐
New Hardware Announcements	☐	☐	☐	☐
New Software Announcements	☐	☐	☐	☐
Product previews	☐	☐	☐	☐
Technology articles	☐	☐	☐	☐
Programming tutorials	☐	☐	☐	☐
Ideas/philosophy	☐	☐	☐	☐
Graphics articles	☐	☐	☐	☐

2. What type of article would you like to see more of in *Creative Computing*? _____

_____

3. In general, do you prefer:

- ☐ Mostly short articles (3 pages or less)
- ☐ Mostly long articles (5 pages plus)
- ☐ Some of each, but more short ones
- ☐ Some of each, but more long ones

4. Of these regular contributors, are there any you particularly like or dislike?

	Like	Okay	Dislike
David Ahl	☐	☐	☐
John Anderson	☐	☐	☐
Jake Commander	☐	☐	☐
Michael Crichton	☐	☐	☐
Will Fastie	☐	☐	☐
Susan Glinert-Cole	☐	☐	☐
Stephen Gray	☐	☐	☐
Bill Jacobson	☐	☐	☐
Barry Keating	☐	☐	☐
Owen Linzmayer	☐	☐	☐
Russ Lockwood	☐	☐	☐
Arthur Luehrmann	☐	☐	☐
Brian Murphy	☐	☐	☐
Corey Sandler	☐	☐	☐
David Small	☐	☐	☐
Betsy Staples	☐	☐	☐
Ken Uston	☐	☐	☐

5. Is there anyone you would especially like to see write for *Creative Computing*? _____

_____

_____

_____

_____

_____

_____

II. ABOUT YOUR COMPUTER (S)

6. Where do you regularly use a computer and what kind is it? (check all that apply)

Type	Mfr & Model	Use at Work	Use at School	Use at Home
Mainframe	_____	☐	☐	☐
Minicomputer	_____	☐	☐	☐
Personal computer 1	_____	☐	☐	☐
Personal computer 2	_____	☐	☐	☐
Personal computer 3	_____	☐	☐	☐
Personal computer 4	_____	☐	☐	☐

7. About the personal computer you use most frequently:

What is it? (mfr & model) _____

Equipped with:

☐ Floppy disk drive (s) ☐ Hard disk
☐ Daisy wheel printer ☐ Modem
☐ Dot matrix printer ☐ Color monitor
☐ Graphics tablet (or equiv.) ☐ Monochrome monitor

About how much did the entire system cost? _____

8. About the personal computer you use second most frequently:

What is it? (mfr & model) _____

Equipped with:

☐ Floppy disk drive (s) ☐ Hard disk
☐ Daisy wheel printer ☐ Modem
☐ Dot matrix printer ☐ Color monitor
☐ Graphics tablet (or equiv.) ☐ Monochrome monitor

About how much did the entire system cost? _____

9. About the personal computer software you use on any computer:

	Use Frequently	Use Occasionally	Sits on the shelf
Word processing pkg	☐	☐	☐
Spreadsheet pkg	☐	☐	☐
Database pkg	☐	☐	☐
Communications pkg	☐	☐	☐
Graphics pkg	☐	☐	☐
Engineering pkgs	☐	☐	☐
Financial analysis	☐	☐	☐
Educational pkgs	☐	☐	☐
Entertainment pkgs	☐	☐	☐
Basic	☐	☐	☐
Pascal	☐	☐	☐
Other language	☐	☐	☐
Music synthesis	☐	☐	☐

What is the approximate value of software you have for your personal computer (s)? _____

III. ABOUT YOU

10. Age_____ 11. Sex ☐ Male ☐ Female

12. Please write in your job function and the type of establishment for which you work. Follow the approach in the examples:

Job Function	Type of establishment
Financial manager	Automobile manufacturer
Dermatologist	3-man practice
Mathematician	Government agency
Writing	Free-lance at home
_____	_____

13. Where do you live (state, province, or country)? _____

14. What are your present annual earnings? _____

15. Comments: _____

_____

_____

_____

_____

_____

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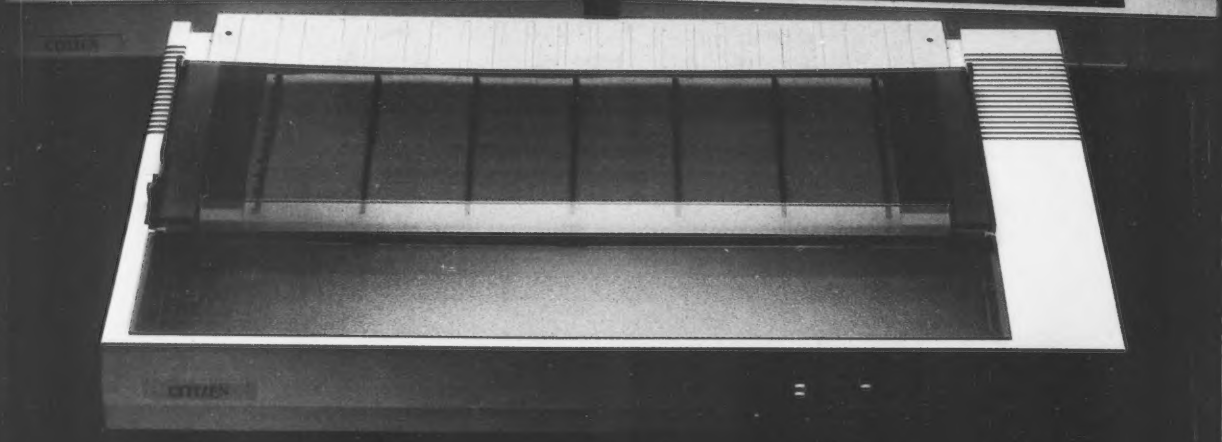

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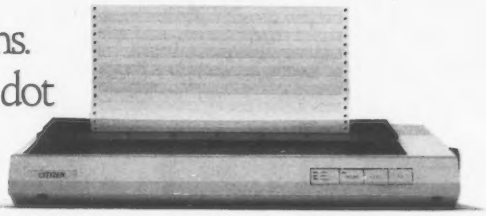

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CIRCLE 109 ON READER SERVICE CARD

Michael Crichton

Betsy Staples

He thinks that hacking is good, the home market is "soft to the point of squishy," and that the main function of home computers will soon be communication.

He is a celebrated novelist, movie director, and, most recently, software author.

He is Michael Crichton whose latest movie is "Runaway" with Tom Selleck and Jean Simmons and whose newest software package is an adventure game called *Amazon* from Trillium Software.

We spoke with him recently as he was putting the finishing touches on the movie.

A truly multifaceted person, Crichton has formal training in none of the areas in which he currently works. He paid his way through Harvard College by writing novels—six altogether, all under pseudonyms. One of them won an Edgar for best mystery of the year it was published.

In 1969, the year he graduated from Harvard Medical School, Crichton published *Andromeda Strain,* one of his best known novels. The following year he went to Los Angeles to watch the filming of "Andromeda Strain," and "I've been here ever since."

It wasn't too long thereafter that Crichton met his first microcomputer. It was actually a dedicated word processor—an Olivetti, which he still uses. When it comes to serious word processing, he says, "there's no contest between even the most sophisticated program for a PC and a dedicated machine."

So enthralled was he with the Olivetti, that a year or so later he bought an Apple II. "I had some vague idea about doing word processing at home on the Apple and at the office on the Olivetti . . . but I gave up."

Deeply involved in movie production by this time, Crichton hired a couple of programmers to attack what was to him one of the most onerous aspects of the business—financial modeling. "It has traditionally been a gruesome task to start with a script and come up with a budget. With this simulation, which runs on an IBM PC AT, we can do the whole thing in about a day."

As an example, he cited "Runaway." Using the simulation, "we came up with a budget for shooting it in Canada. But they (the studio) wanted to know how much it would cost to do it in Los Angeles. It took them nine man-days to prepare a budget for L.A. If they had asked us, we could have given them the figures in about a minute."

"Anyway," he says, "I had started to supervise the creation of a system to model a production, and to do that I felt that I really needed to know something about the problems of the programmers who were working on it. So I sat down with my Apple and taught myself Basic programming."

Although he does not consider himself an expert programmer or serious hacker, Crichton is in favor of hacking and the people who do it. He explains: "It's perfectly OK for a movie director to eat and sleep movies and to have no other interest in life—that's Stephen Spielberg. He's applauded for it; he's lionized. It's fine for a symphony conductor to have no other interest than music, or for a painter to live to paint. So why isn't it OK for a person who loves computers to be totally wrapped up in computers?

"I think the answer is that it is OK. I like hacking. I think the most boring thing in the world is to sit down with a bunch of flowcharts and think everything out before you start programming."

As he became more proficient in Basic, Crichton began to think about writing a game.

As readers of his books know, Crichton is a wonderful storyteller, and although he changed media in *Amazon,* his intention remained the same: "I wanted to tell a story," he explains.

"*Amazon* tends to make you want to do one episode after another. For example, you cannot get to the Lost City without crossing the river and climbing the volcano and dealing with the natives. It's like beads on a string. The episodes can be strung together in different orders.

"My interest is not in creating a puzzle space; my interest is in trying to tell a story in a new way."

To create this new kind of story, Crichton joined forces with programmer Stephen Warady and set to work on *Amazon.* The first problem he faced was deciding how his adventure story would relate to the adventure genre as a whole that had gone before.

In the name of novelty or innovation, he could have determined to ignore his predecessors and break new ground on every level. But, he says, "I was very hesitant to say that all the conventions of adventure playing were silly and I wasn't going to use them."

Instead, he decided to use established conventions where they made sense and incorporate new ones where they seemed appropriate in the story.

Some sections of the game Crichton programmed himself in Basic and had translated into machine language, because "I don't do that very well. But when I turn on the machine, it looks the same as what I wrote."

The things he wrote include the graphics routines for the main titles, modules that deal with turning the computer (in the game) on, and all the sound effects.

He worked closely with the programmer, turning over to him a flowchart of all the text and a map of all the locations as well as the color graphics frames.

With the game finished, we asked, how did he select Trillium to market it? "They showed up. It was really funny. Just about the time the game was being

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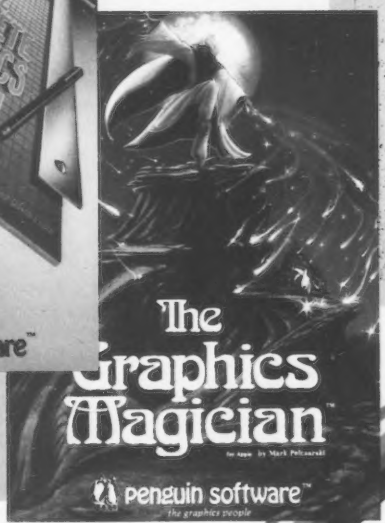

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PEOPLE

completed and we were trying to decide what to do with it, Seth Godin of Trillium called and said he was starting a line of software."

When we questioned him about the wisdom of getting involved in the home entertainment software market at a time when "industry observers" are predicting its imminent demise, Crichton says "I've always said that the home market is soft to the point of being squishy." What he sees for the home entertainment market in the future—at a time when machines are widespread—is a kind of entertainment somewhere between movies and computer games—interactive fiction for the whole family. "But that won't happen this year."

What is the best reason for buying a computer this year? "My sense is that eventually everyone will have a machine for communication. The reason that you will have a computer in your house is the same reason that you have a telephone in your house. It's not an issue; almost no one says, 'Why do I have to have a phone?' You're an American so you have a phone in your home—and maybe even in your car."

"Right now, whenever somebody says to me 'I don't have any use for a computer,' I say, 'Right. You don't.' I'm tired of trying to talk them into it."

No one has had to talk Crichton into it. "I have many more computers than I have hands," he says. His current collection includes an IBM PC/AT, an HP Portable, a TRS-80 Model 100, a standard IBM PC, the original Apple II+, a Commodore 64, and the Olivetti word processor that started it all. For work travel, he prefers the Model 100.

To our travel-minded readers we recommend a trip to the *Amazon.* For those who can't wait until the next trip to the software store, we recommend the original Crichton program on page 126 of this issue. ■

PROFILES

Barbara Blackburn

The world's fastest typist, Barbara Blackburn, is a proponent of the Dvorak method of touch typing. Blackburn, a 64-year old grandmother, can better her record-breaking QWERTY pace of 150 words per minute by an additional 50 wpm simply by switching to the Dvorak layout. Scarborough Systems of Tarrytown, NY, drew upon Blackburn's expertise during development of *New Improved Mastertype,* an enhanced version of the firm's best-selling typing tutorial, which includes lessons for Dvorak users.

James A. Gosling

Dubbed the Birdman of CMU by the Carnegie-Mellon University alumni magazine, James A. Gosling takes full credit for a prank that changed the face of the sleek new Computing Center at the University. Inspired by the casual observation that the black and grey glass building "needed a little color," Gosling searched high and low for a pair of pink flamingos, which he then installed on a section of roof outside his second floor office. Gosling, an IBM employee and system designer in the Information Technology Center, denies that the birds are a statement about the building. Instead, he contends that they prove "there are people in here."

Albert Vezza

Infocom, long noted for challenging and innovative entertainment software, recently entered the business software market with *Cornerstone,* "a relational database system for the non-programmer." "The move to this market has been long planned," says Albert Vezza, chairman and CEO of the company. "Early in 1982 we anticipated the emergence of a new market for business software—professionals who have neither the time nor programming experience to use complex software." Vezza is credited with organizing the original group of partners who launched Infocom and with having a great deal of influence on the evolution of the company. His philosophy has been to combine highly motivated and creative technical and entrepreneurial talent in a stimulating environment. ■

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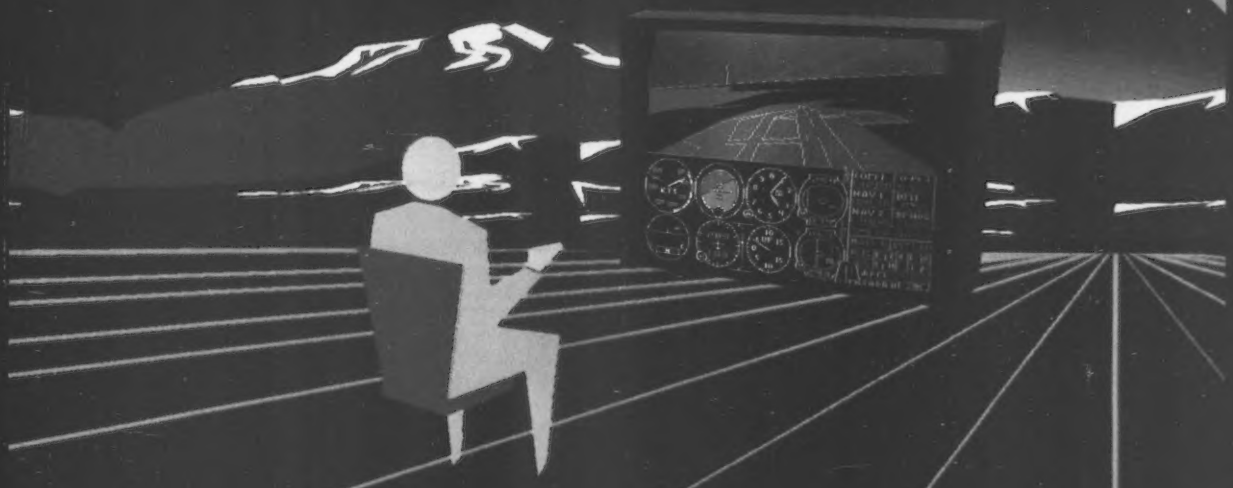

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TELECOMMUNICATIONS TALK

Modem speed: what does it mean to you?

Corey Sandler

Is twice as fast twice as good? Will half the price end up costing you double? And while we're on the subject, just how high is up?

These are some of the very real questions facing modem users and buyers these days, as the telecommunications hardware industry speeds into 1985, a period that seems to have unofficially designated as the Year of the 2400 Baud Modem. Seven modem manufacturers were first out of the gate with introduction of new models last fall. If the recent history of manufacturing in microcomputerdom is any gauge, those models should just be arriving in computer stores about now. The early participants are: Cermetek Microelectronics, Hayes Microcomputer Products, Multi-Tech Systems, Novation, Racal-Vadic, Telenetics, U.S Robotics and Micom.

Micom DialNet3000 2400 baud modem.

A modem changes the digital pulses of a microcomputer into an analog warble that can be sent over a telephone line. The act of changing a digital pulse into an analog waveform is called modulation; the translating the other way is called demodulation. Hence, the phrase modem from a concatenation of the two words. A modem rated at 1200 baud is theoretically capable of sending or receiving 1200 bits of information per second; the 2400 baud modem can send 2400 bits per second.

Most computers store data in the form of 8-bit words, or bytes. Each computer "word" is equivalent to an ASCII character. Typically, there are about 5.5 characters in the average English language word. Therefore, the 2400 baud modem's 2400 bits a second speed is equal to about 300 characters, which translates to approximately 55 words a second. A 10,000 word data file should take approximately 184 seconds, or just over three minutes to send.

At 1200 baud, the throughput is theoretically half—about 150 characters or 27 words a second. A 10,000 word data file should take approximately 368 seconds, or just over six minutes to transmit.

Many microcomputer owners, especially those with simpler or less expensive machines, use modems rated at 300 baud. The equivalent numbers: 300 bits per second, equivalent to 37.5 characters per second, or 6.8 words per second. The 10,000 word file would crawl across the phone lines in 1470 seconds, or 24.5 minutes of warbling.

The Courier 2400 standalone auto-dial modem by U.S. Robotics.

Obviously, the faster the modem the more theoretical speed for your transmissions. But let's go back to the questions posed at the start of this column. The answers appear to be: 1) Sometimes but not always; 2) It could, in certain situations; and 3) Up seems to sit somewhere around 9600 baud.

More Baud for the Buck

The cost of a 2400 baud modem now seems to have settled in a range of 15 to 25% above that of its half-as-fast 1200 baud cousins. For that extra $100 to $200 or so, you get the theoretical saving of 50% on telephone charges, plus the value of the time of the human operators or users at each end of the line. On that basis, going to a 2400 baud modem represents a real bargain.

To determine the most efficient and economical speed for you and your particular microcomputer use, you'll have to give some consideration to several other factors related to the nature and amount of use, and the characteristics of the human and electronic equipment at each end.

To begin with, remember that the modem speed (and a few other protocols of communication) must be the same at both ends of the phone line. If the party or service you will be communicating with is limited to 1200 baud, that is the fastest setting you may use. (Almost all of the new 2400 baud modems also allow use at 1200 and 300 baud speeds, so you could lay out the extra cash now in expectation of future payoffs. Then again, prices are heading inexorably downward.)

Hayes Smartmodem 2400.

Next, bear in mind that not all telecommunications public networks have established 2400 baud input lines. At the time of writing, Tymnet has hooked up a handful of high speed links around the country, but Uninet, MCI, and others had not yet joined the group. Count on this to be a short-term problem, though.

And then there is the unpleasant and unrealistic attitude of some public networks that have decided that if they charge a 1200 baud user $1.50 per minute, they should charge a 2400 baud user $3 per minute. Not only does this

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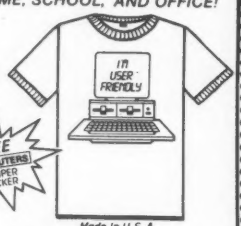

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negate the theoretical cost saving of high speed transmissions, in some instances it could end up making such communications considerably more expensive.

Anyone who has used a public network like The Source or the Dow Jones News Retrieval Service knows that you can end up spending a good part of your time tapping your fingers on the desktop instead of the keyboard while you wait for the mainframe computer at the other end of the line to get around to responding to your request or delivering the information you have requested. It is not that the mainframes are slow—hardly—it is that you are just one of perhaps dozens of users vying for split seconds of CPU, disk storage, or input/output switching. Your message to the mainframe zips along the lines at high speed, and the response of the mainframe comes back to you at the same speed, but in between you're just another fish on the line. And the meter keeps ticking away, at double charge for transmission and receipt of nothing at all.

A more reasonable approach for billing by public networks might involve a structure that charges for use of the telephone line, regardless of the speed of characters sent over it, and a charge for the amount of CPU time grabbed by your microcomputer. Is anyone out there listening?

Signal Quality

And finally there is the question of the quality of the signal and the nature of the error-checking system used by the computers at each end—elements not directly related to the modem hardware. A particularly bad telephone connection can result in the modems transmitting and retransmitting blocks of data several times before a successful exchange is made. A 2400 baud modem might end up being slightly more choosy about the quality of phone line it will accept. And certain software protocols require extra levels of checking before data are accepted.

Nevertheless, you will notice a significant increase in speed whenever you up the potential raw speed of your modem. If you or your company does a lot of telecommunication directly between offices—dumping data or retrieval from a database or heavy use of electronic mail, the higher speed will pay for itself in phone charge savings in days or weeks. If, on the other hand, you use your modem to "chat" on a CB simulator on CompuServe, you will not notice much of a change—you type considerably slower than 300 characters per second, as does the person with whom you are communicating.

Years ago, when some modems spoke to each other at 110 baud and 300 baud was considered zippy, it appeared that the speed limit would reside somewhere around 1200 baud. This was in part due to limitations presented by the microcomputer hardware and in part to limitations of the telephone lines. The problems with microcomputers have been dealt with by speedier microprocessors, input/output controllers, and improved circuitry in the modem itself. The problem with the telephone lines has been dealt with by some very creative engineering by modem designers.

Going from 1200 baud to 2400 is simply a matter of cramming more signals closer together in a particular moment of time. Poor phone lines, though, can rob the signal of its strength or introduce noise that will distort the message. One solution chosen by U.S. Robotics and a few other manufacturers, involves a step away from the present technology, called "compromise equalizers," toward circuitry called "automatic adaptive equalizers." This new technology in effect has the modem constantly checking the changing nature of the telephone line and making adjustments in the amplitude and other characteristics of the signal being sent. This circuitry is also available when the modem is being used at a slower speed, improving communications there as well.

How High is Up?

The next step up may be 4800 baud or a leap to 9600 baud, using technologies called "echo cancellers," and "channel coding." Right now, modems operating at those speeds are available, but the price premium puts them out of reach for all but very high volume telecommunications users.

But consider this: sales of modems for microcomputers have been growing at a phenomenal rate recently; some estimate one million units were sold in the last year, with the curve still headed upward. Economies of scale and the increased use of LSI and VLSI (Large Scale Integration and Very Large Scale Integration) chips is expected to bring the price of modems way down, perhaps to the $100 level for 1200 or even 2400 baud devices. When that happens, your wrist computer can reach out and touch someone with speed and efficiency Dick Tracy only dreamed of. ■

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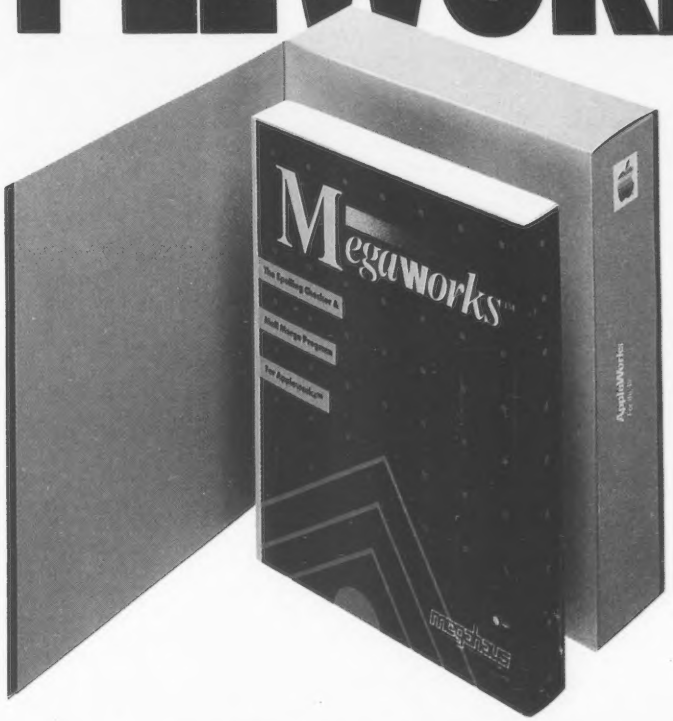

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Computer Graphics: Misunderstood and Underutilized

David H. Ahl

Although personal computers are now found on the desktops of more than 10% of the managers in the nation, fewer than 2% claim to use the machine routinely to do any kind of graphics work. Why so few?

Although there are no exhaustive surveys, I suspect there are two major causes. The first is technophobia, the fear of technology, indeed the same fear that prevents the computer from getting to the desktops of many executives at all. However, in this case, users are put off by the seemingly complicated hardware interfacing (to a plotter, light pen, or graphics tablet), the lack of software compatibility (*EnerGraphics* looks nice, but can I use it with *Microplan*?), and the concern that learning time might be excessive.

The other cause of not using graphics I believe can be summed up by the statement, "I'm not artistic." Case in point: a sales manager labored hard and long massaging extensive survey data with a spreadsheet and preparing an excellent narrative on a word processor. It was a masterpiece of a sales presentation. One of his competitors had little hard data and very few persuasive words, yet his company kept landing the sales. Why? Because the second presentation had excellent charts and graphs, the meanings of which were quickly grasped and rememberd by harried buyers.

I spoke to the first sales manager and asked him why he didn't use graphics in his presentation. "Our art department is too busy and I had to get this out," he said. "Why not do it on your computer?" I persisted, noting the office had many IBM PCs and Apples around. "Oh, I couldn't do a very good job on charts. I can't even draw a straight line."

But that's exactly the point: with most computer graphics packages you don't have to be able to draw a straight line. Moreover, in contrast to someone in the art department who may spend hours laboring over a single chart, you can re-do things dozens of times in a reasonable amount of time until you get a professional looking chart. Chances are, that you won't have to, since most of the current generation of programs do scaling and fitting automatically. (In case you missed it, we reviewed 23 business graphics packages in the July '84 issue. Had the sales manager mentioned above read this section, he would have found no fewer than ten packages with which he could easily make bar, line, and pie charts.)

However, I would like to take one step beyond traditional business graphics—mostly charting, statistical, and "slide show" packages—and suggest that business managers should start to become familiar with the next generation of desktop computer graphics. I don't expect to see any great surprises in the graphics techniques themselves—most are currently in use on specialized or large scale machines—however, increasingly they will be available on desktop machines. Like the two sales managers above, the person who is willing to use these new forms of computer graphics will have a major competitive advantage.

On The Horizon

Let's look at a few of the coming types of computer graphics starting with what has just been announced and pushing on out into the future.

Interactive Plotting. In a spreadsheet, you can change a single assumption and watch its effects as the sheet is recalculated. Integrated spreadsheets such as *Lotus 1-2-3* let you see a graph almost immediately. However, new windowing packages let you change a spreadsheet number in a small window and watch the effects on the graph. Imagine that at your next planning session!

Cartography. Using computers for the production of maps is nothing new; however, overlaying a second or third variable on the map makes it much easier to understand the inter-relationship between geographic location and, say, natural resources, population density, or market potential.

Computer Aided Design (CAD). In CAD, interactive graphics are used to design components and systems of mechanical, electrical, and electronic devices. While sometimes the emphasis is on producing accurate drawings for the construction of the system or subassembly, increasingly the emphasis is on interacting with a computer-based model of the system in order to test its properties or behavior under various circumstances.

Simulation and Animation. As in interactive CAD, you can study models of existing and proposed systems pictorially. Although simulations are generally thought of in conjunction with scientific and engineering processes (hydraulic flow, stresses on an auto suspension, chemical reactions, spacecraft maneuvers), they are also being used in other areas such as population migration, brand loyalty and shifting behavior, and value analysis of complex systems.

Graphics Communications. Frequently, two or more people not located at the same site must confer about graphics images. At least one system has been announced that allows the same image to be manipulated simultaneously by people at two sites. In the near future, this will be possible with animated images as well.

Easy Art. Anyone who has a Macintosh or knows someone who does has seen the ease with which elaborate type fonts, borders, and little pictures can be done. Indeed, it is a rare Mac owner who hasn't overdone it in the first few weeks—some haven't stopped yet—because it is so easy. For a change, the computer is on your side. Increasingly, these capabilities will be available on other machines. More important, however, is the fact that these capabilities will be integrated with other packages and users will learn (one hopes!) to apply them in appropriate ways. Office posters will be the first thing to take on a new look, but this will be followed soon by memos, letters, and all forms of business and personal communication.

So if you have been resisting—deliberately or unwittingly—using computer graphics, resist no longer. The old saying has it that a picture is worth 1000 words; the same can be said for a computer graphic. But what about an animated 3-D graphic? Surely worth 10,000 words, a closed sale, and a promotion. ■

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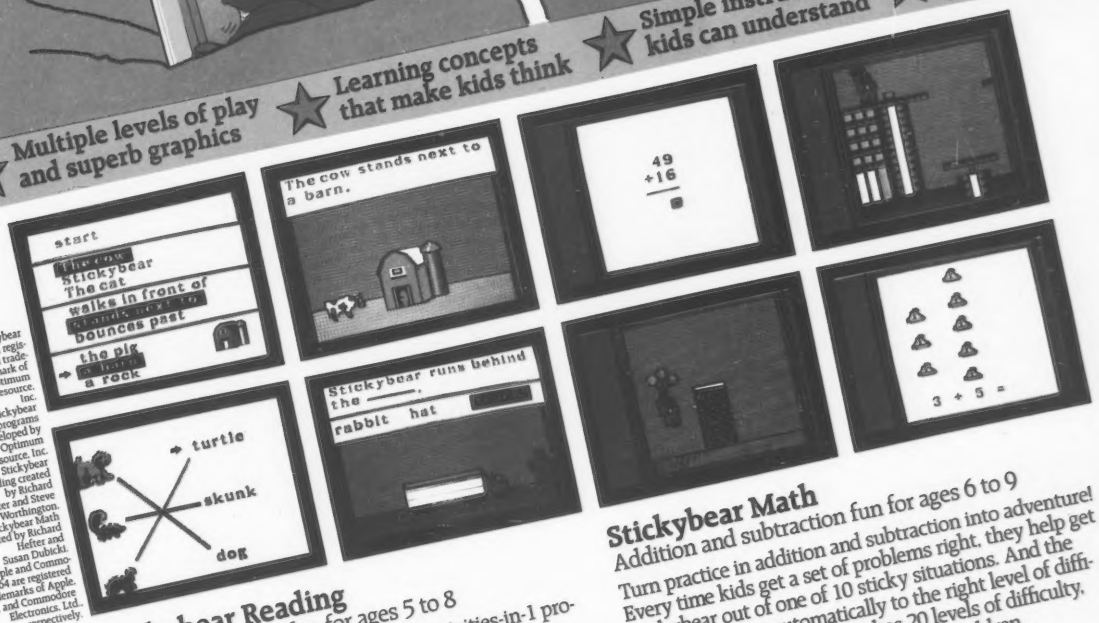

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Data General Portable PC

Corey Sandler

Is the Data General/One the crowning achievement of the IBM-compatible laptop portable race? Or, is it yet another triumph of nascent technology over real-world utility?

Well, it all depends on how you see it.

The DG/One is an MS-DOS compatible, full-keyboard, battery-powered microcomputer that can be equipped with a pair of built-in disk drives and 300 baud internal modem. It is possessed of the first commercially applied full-screen (80 characters by 25 lines) liquid crystal display (LCD). And, though at 11 or so pounds for the standard configuration it is not quite the weight or size of a three-ring binder, it does honestly qualify for the title of "portable."

Prices start at a hefty $2895 for a 128K, one disk drive machine. A second internal disk drive lists for $599, and each block of additional 128K of RAM is listed at $599. The internal modem lists for $250, an external 5.25" disk drive for $795, and a portable thermal printer for $499. A battery pack and recharger and a carrying case for the whole system each list for $99.

Under the hood beats an 80C88 microprocessor heart, the low-power CMOS equivalent of the 8088 chip used in the IBM PC and compatible machines. The DG/One comes equipped with at least 128K of RAM, expandable in blocks of 128K to as much as 512K. However, the video display circuitry of the machine does not have its own memory, and therefore you must lop off the first 48K of RAM for the screen. If the program you intend to use requires 256K of RAM, you will actually have to move up a notch to a 384K machine.

And, unlike many other laptop portables, the RAM is not kept under power when the computer is shut off; like a standard microcomputer, the RAM is volatile and information in it disappears when the power is shut off or the bat-

The Data General/One comes with one 3.5" disk drive built in. A second drive is optional.

Hardware Profile

Name: Data General/One **Type:** Portable PC-compatible computer **CPU:** 80C88 at 4MHz **RAM:** 128K standard, can be increased to 512K in blocks of 128K **ROM:** 32K **Operating System:** MS-DOS 2.11. Can also use CP/M-86 **Keyboard:** 79 keys, with 10 function keys **Display resolution:** LCD display of 640 by 200 pixels, or 25 lines of 80 characters **Ports:** Two serial ports built in. Expansion chassis that will accept IBM compatible hardware cards announced **Dimensions/wt:** 13.7" x 11.7" x 2.8". Approximately 11 lbs. with two disk drives **Documentation:** Instruction manual **Summary:** The first commercially available full-screen LCD portable computer with a high degree of PC compatibility **Price:** $2895 for unit with 128K of RAM, one internal disk drive.

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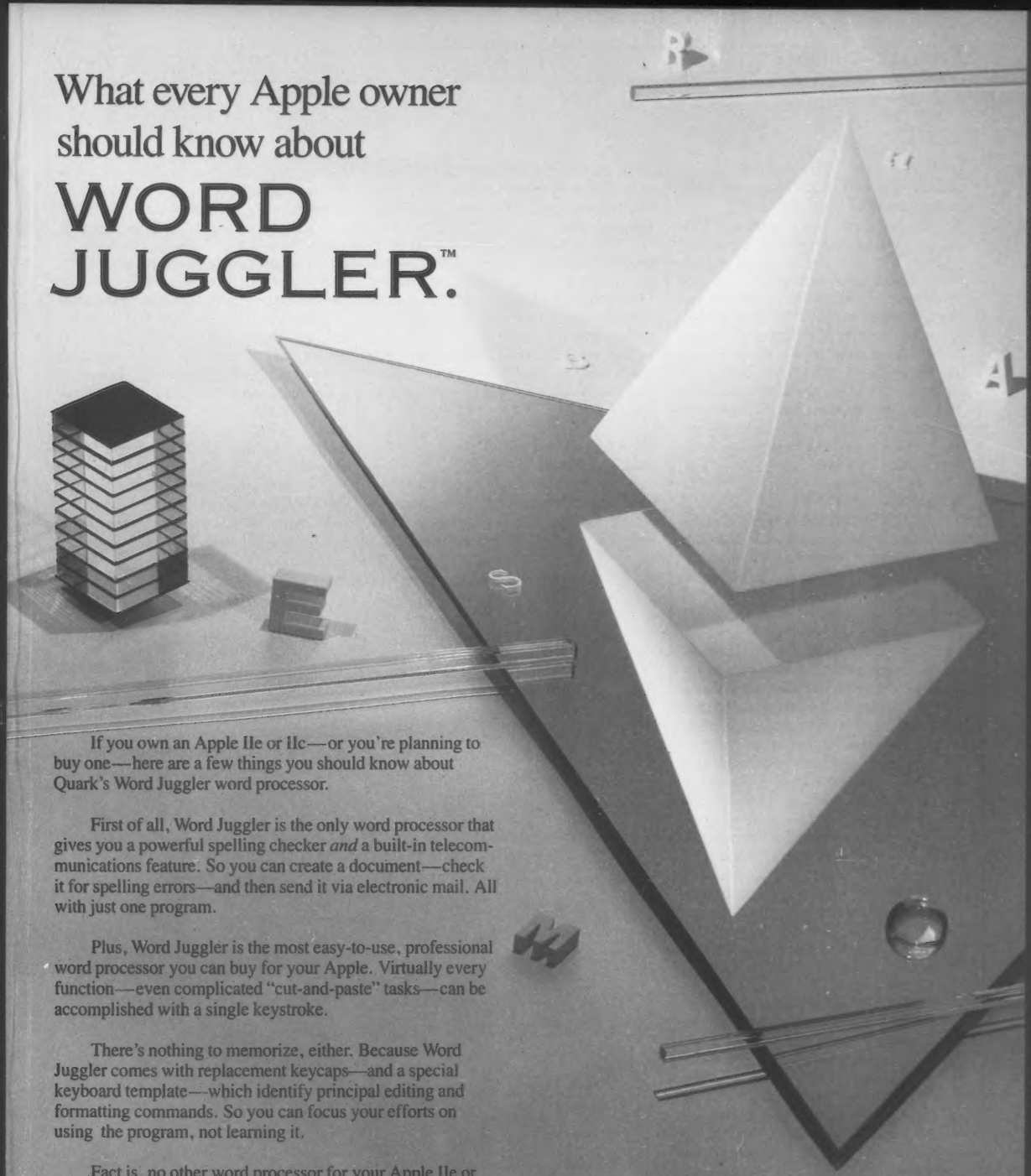
What every Apple owner should know about WORD JUGGLER.™



If you own an Apple IIe or IIc—or you're planning to buy one—here are a few things you should know about Quark's Word Juggler word processor.

First of all, Word Juggler is the only word processor that gives you a powerful spelling checker *and* a built-in telecommunications feature. So you can create a document—check it for spelling errors—and then send it via electronic mail. All with just one program.

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There's nothing to memorize, either. Because Word Juggler comes with replacement keycaps—and a special keyboard template—which identify principal editing and formatting commands. So you can focus your efforts on using the program, not learning it.

Fact is, no other word processor for your Apple IIe or IIc gives you this unique combination of power, functionality and ease of use. And if all these advantages aren't compelling enough, check the price. Suggested retail is only $189.

So visit your favorite dealer today. Ask for a complete demonstration—and for a copy of our brochure, "What Every Apple Owner Should Know About Word Juggler." If you don't have a favorite dealer, but would like one, just call 1 (800) 543-7711. We'll fix you up.

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teries run down. You must be certain that the contents of RAM are copied to permanent storage on disk.

The computer has several disk storage options, beginning with one or two built-in 3.5″ disk drives. These drives, based on the Sony technology also used by Apple in its Macintosh machine, can store as much as 720K of data each—twice the capacity of the IBM PC floppy disk drives and two-thirds of the way to the high-density storage of IBM's 1.2 megabyte drives in the PC-AT machine. The disks are formatted at 512 bytes per sector, with eight or nine sectors per track, and 40 or 80 tracks per side, yielding the 720K top end.

Safe and Sound Disks

The disks themselves are nicely protected inside plastic carriers, with a sliding metal door protecting the medium from fingerprints, dirt, and paper clips. However, because the size and design of the drives are different from the 5.25″ floppy system found on the IBM PC, using a program written for the IBM requires a few extra steps—you must either buy special 3.5″ disk versions of software or download programs from a 5.25″ drive or a telecommunications source. Data General sells an external 5.25″ drive with connector to the DG/One to allow direct exchange of magnetic media with an IBM PC or compatible.

Be aware, though, that you will not be able to transfer copy-protected software to the smaller disk format, and that the software use license for a particular program may legally limit use of a program to a single computer. The seller may object to a user making copies for use on a PC at the office and a DG/One for the road.

Another issue involves software that is tied directly to hardware rather than to the MS-DOS operating system. Data General appears to have done a good job of ensuring near-total compatibility through careful design of its BIOS system which is present as part of its adapted MS-DOS system. Data Geneal provided downloaded 3.5″ disk versions of standard *WordStar* and *ThinkTank* for this review. The system also booted up IBM DOS 1.1 on one disk I tried.

Data General has announced that it will make available soon an expansion unit for the portable that will include five IBM-compatible hardware slots and hold an external 5.25″ floppy disk drive or another storage option. The box—the size of a small desktop computer—will allow use of an IBM or compatible display card and other devices. The price had not been set at the time this article was prepared.

The MS-DOS package from Data General includes Microsoft's GW-Basic, which is a functional equivalent of IBM's BasicA. (Here is a free inside tip: If an applications program on any PC-compatible absolutely insists on finding a program called BASICA.COM before it will execute, you may be able to save the day by renaming GW-Basic as BasicA.)

The LCD: Good News and Bad News

It is the LCD display that is both the boon and the bane of the machine. By opting for the full-sized screen, Data General (and its Japanese manufacturing and design arm Nippon Data General) has dealt nicely with one of the most damning criticisms aimed by many at the rest of the crop of laptop computers.

Pioneering devices like Radio Shack's Model 100 display only 8 lines of 40 characters. Other newer machines like Epson's PX-8 have pushed the frontier to 8 lines of 80, while Hewlett-Packard's Portable goes one step beyond to 16 by 80. And in November, Texas Instruments announced its entrance into the fray with a device called the Pro-Lite, which includes an LCD with the same display abilities as those of the Data General/One.

Data General's machine mimics the full IBM PC display. It will show a full page of text from a word processor, or it can show a full-sized *Lotus 1-2-3* screen.

The LCD screen of the DG/One displays 25 lines of 80 characters in the same proportions as a CRT screen.

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(3) RS-232C Cable
(4) Communications Software
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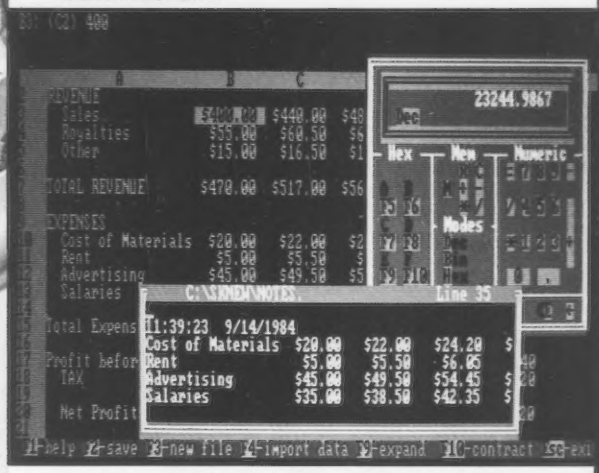
Jerry Pournelle, BYTE

Here's Sidekick in action. That's Lotus 1-2-3 running underneath. In the Sidekick Notepad you can see data that's been imported from the Lotus screen. On the upper right, that's the Sidekick Calculator.



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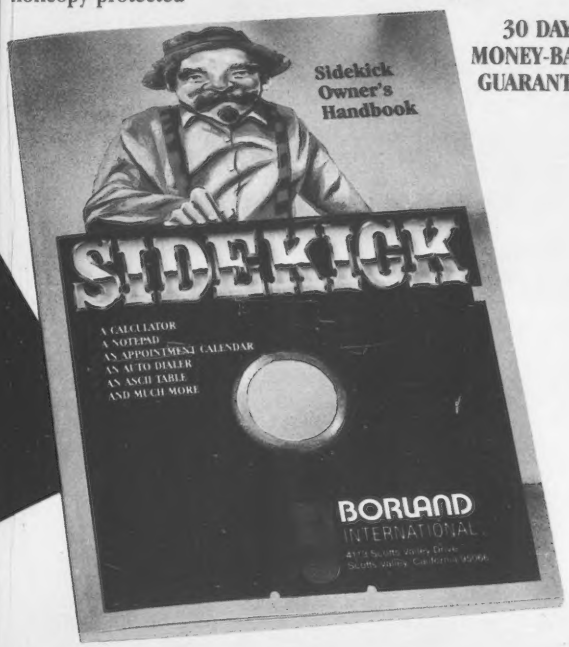

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Whenever you're using your computer . . . from start to finish of your session . . . Sidekick™ will be there . . . ready to serve. And it's as lightning-fast and compact as only Borland knows how to make it.

There's a notepad that has a full-screen editor that can time and date stamp your notes, and then save them to disk. You can even pull information into the notepad directly from the screen of your "underlying" software.

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There's lots more, too. You can move the Sidekick windows anywhere on the screen you like. And you can have as many on screen at a time as you need. There's even an on-line help window for each of Sidekick's features.

We designed it because we needed it. If you've ever been writing a report and needed to do a quick calculation, or jot down a note, then you need Sidekick, too.

†*Only with Hayes Smartmodem and compatibles.*

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And, if you are so inclined, you could check up on the pilot by running the standard (monochrome) screen of *Flight Simulator* on your lap as your jet lines up on final approach to O'Hare.

The inherent nature of the LCD screen is that it works with the aid of reflected light rather than as a light source itself like a cathode ray tube (CRT) or other luminescent technologies (see "Hi-Res and Color Liquid Crystal Displays" in this issue). And, it seems that the larger the screen and the smaller the pixels (and therefore the more information displayed) the more difficult it is to find just the right amount and angle of light for viewing.

The reason the LCD screen has been adopted by nearly every manufacturer of battery-powered portable computers is that it draws very little current, thereby allowing the use of relatively small and lightweight batteries. Other technologies, such as electroluminescent screens, plasma displays, and low-power CRTs for battery-operated machines, are still in the labs.

Impressed though I was by the technological achievement of the full screen, I found it a bit of a strain to read in most situations. The best lighting I found was from a strong but indirect source over my shoulder—I'm not certain that an airliner's overhead spotlight would save me from a headache. The contrast of the DG screen can be adjusted through commands from the keyboard, but the angle of the screen cannot be changed—it is either open or shut. And, the characters on the review model I used did not seem as sharp as those displayed by the smaller and more limited Radio Shack and Epson machines I have used.

The Vital Statistics

The device itself is also larger than the "typical" laptop computer, measuring 13.7" by 11.7" by 2.8". Its starting weight is 9 pounds, with a single disk drive and without the optional rechargeable battery pack. With a second drive and batteries, the system crosses the 11-pound threshold. I was quite surprised to discover that the unit did not include a built-in carrying handle; a separate case or briefcase is necessary.

The batteries are supposed to be good for at least eight hours of typical use—disk drive and modem operation consume more power than do screen display and computation. Recharging the batteries requires use of a small transformer cube and power cord; operating the computer directly from an AC outlet requires a different transformer cube and power cord.

The microprocessor runs at a clock speed of 4 MHz, almost 20% slower than the IBM standard of 4.77 MHz. The difference was noticeable in computation-intensive operations like screen updates. Data General included with my review package a copy of a PacMan-like game, and fighting boredom I was able to rack up record scores by outrunning the slightly slower ghosts.

Users familiar with the forgiving nature of the entrance slots of most 5.25" disk drives will find the DG units to be slightly more demanding: the plastic case must be inserted exactly right or it will not drop into place for reading and writing operations. The disks include a small movable notch to write-protect contents—an improvement over the silver tape method used for floppies. By the way, the prices of the 3.5" disks have settled thus far in a range of about twice the price of a 5.25" floppy. Byte-for-byte, that makes the media identically priced.

Programs and data can be copied into and out of the RAM disk at a significant increase in speed over the physically limited real disk drive.

The optional 5.25" disk drive is called device C by the operating system, but the DG ROM BIOS has been told to boot from drive C if there are no disks in the first two internal drives. This should allow programs with their own operating systems to load from the external drive.

Making Your Own Disks

Copying from a 5.25" disk to a 3.5" disk is a straightforward procedure using the COPY or DISKCOPY command. (Using DISKCOPY, though, will format the smaller but more capacious disk as a standard 320K or 360K disk, depending upon the formatting of the original.)

Going the other way, from the small internal disks to the external floppy requires the COPY command, and you must consider the halved capacity of the floppy—it could take two floppies to store all of the data recorded on a single 3.5" disk.

One other storage option for DG users is a RAM disk (also called an "electronic disk" or a "virtual disk"). This is a program that fools the operating system into thinking of a portion of RAM as a disk. Programs and data can be copied into and out of the RAM disk at a significant increase in speed over the physically limited real disk drive. You must take care to observe two cautions, though: first, any data in the electronic disk must be stored to a permanent disk before power is shut off, and second, you must leave sufficient RAM available for the needs of an application program. For example, *WordStar* requires at least 128K. Together with 48K for the screen display memory, the first 176K must be left untouched in such an application. DG's supplied VDISK.COM program creates a CONFIG.SYS add-on to DOS, calling the RAM disk drive D.

The DG/One keyboard is a competent device, about half an inch narrower than a standard typewriter or computer board. The 79 keys have a sure, clicky feel to them, slightly softer than the IBM PC model but should prove quite comfortable for most users. Across the top of the board are ten downsized function keys, plus Ins, Del, Num Lock, Scroll Lock, and PrtSc buttons. A carrier just above the function row holds a plastic cheat sheet card that can be used to remember specialized assignments given the keys.

In addition to the standard Shift, Ctrl, and Alt keys, DG has added a Cmd key, a Spcl key, and a blank and thus far unassigned key along the right side of the board. A set of four cursor control keys resides along the bottom right—the horizontal placement of up, left, right and down are not my favorite arrangement. The small board understandably does not include a separate cursor key pad. Instead the UIO/JKL/M keys can be toggled into roles as the bottom half of a keypad for number entry.

A Choice of Video Options

The DG/One equivalent of a video display adapter can be set to emulate the IBM special monochrome adapter and screen or the IBM Color/Graphics adapter. Commands from the DOS prompt can also set the display to 40 characters. At the Comdex show last November, I saw the DG/One with a prototype of the expansion box with a standard IBM Color/Graphics board driving an RGB monitor.

One of the more common uses for a

portable computer is as a link to a main office computer for electronic mail, database inquiry, or transfer of files. Other users tie into public networks like MCI, the Source, and CompuServe for various purposes. The DG/One accommodates these uses through an optional 300 baud direct connect modem, or through an RS-232C serial port that can be wired to an external modem. Data General will offer a 1200 baud device, but the price had not been set at the time of this review.

The DG internal modem follows Hayes protocols, including auto-answer. The device comes with a T-connector allowing a telephone to be plugged into the same line to allow you to switch back and forth between voice and data communications. Also available is a set of acoustic cups to be used with non-modular telephones.

I tried the modem with MCI mail and had no trouble using that system's commands. I did not have a full-function telecommunications program to test uploading and downloading. One word of warning: the communications chip set used in the CMOS system of the Data General is not the same as that used by the IBM PC and most compatibles, and as such it is a good bet that many off-the-shelf communications programs will not work on the machine. You'll probably have to use an altered version.

I also successfully linked the DG/One directly to my IBM PC using a null modem cable, the system I use to download data from my personal portable. The two computers, both under control of my IBM, swapped files at a gratifying 9600 baud.

The Built-In Programs

The DG/One includes four small-scale utility programs on a ROM chip inside the unit, including a terminal program that allows configuration of the portable as a standard terminal or as an emulation of a Data General Dasher terminal. Options include use of an internal or external modem, output flow control, and several other protocol elements—but no way I could discover to save files to disk or retrieve from disk or RAM.

Another of the ROM programs is Notebook, a simple text processor that can be used in conjunction with the modem for sending and receiving files, or as a quick memo pad. The program will hold as many as 500 lines of 80-column text in RAM. The other two options are a Setup configuration program (the settings are retained in a small portion of RAM that is powered by a separate lithium battery that also runs an internal clock/calendar) and a set of extended diagnostic routines to check memory chip-by-chip and test the various available disk drives.

There is also a built-in self-diagnosis program that is invoked when the computer is first turned on. The test reports net available memory (48K of RAM is taken by the operating system) and then a numeric code indicating any tests failed by the computer. The routines check the microprocessor, RAM, ROM, DMA controller, LCD controller, keyboard and speaker interfaces, various interrupts, power supply, output ports, and the internal memory if installed.

A hinged cover at the back of the unit slides into place to cover the panel of connectors at the back and also serves as a prop to adjust the angle of the machine; it popped out of its grooved track every time I used it.

DG also sells a portable 27-pin thermal matrix printer that connects to its own serial output port on the computer. Powered either by its own set of rechargeable batteries or from an AC outlet, the device can work with regular bond paper using a special thermal transfer ribbon, or with specially coated thermal paper. According to Data General, the printer emulates an Epson MX-80 with Graftrax or its close cousin the IBM PC Graphics Printer, running at 40 cps for draft quality and 20 cps for "letter-quality" printing.

What's New?

The DG/One pushes LCD technology to its present commercial frontier. In addition to obtaining sufficient supplies of the new large screens (Epson is reported to be one of the OEMs), engineers also found a way to deal with the "ghosting" problem often associated with LCDs. In effect, the large DG/One screen is treated by the computer as if it were several smaller screens with an individual driver for each portion of the display.

Another interesting design choice was the use of 8K by 8-bit RAM chips instead of the more common 64K by 1-bit chips. Both devices will store a total of 64K bits, and therefore in a bank of eight will store 64K bytes. However, the IBM PC design stores each bit of an 8-bit byte in a separate chip, while the DG stores all eight bits in a single chip, saving another smidgen of power.

The construction of the machine seems solid, although the plastic shell does have the appearance of a device selling for less than $3000. A hinged cover at the back of the unit slides into place to cover the panel of connectors at the back and also serves as a prop to adjust the angle of the machine; it popped out of its grooved track every time I used it. DG does not endorse users taking the covers off to install add-ons. If the machine does make a significant dent in the marketplace, though, third-party manufacturers may seek to tie into the planned expansion chassis or attach to one of the ports.

Who should consider buying a device like the DG/One? Well, I spoke recently with a book editor who said his company's sales staff was lugging one of those 40-pound "transportable" PC-compatible machines around the country for use in order entry and communication with the home office—the DG/One would be a quite worthy, back-saving replacement. It would also make a worthy companion for traveling heavy users of electronic spreadsheets.

You should have noticed by now that the only significant knock against this machine—assuming you can afford the price of admission—is based on a completely subjective decision about the LCD screen. A long word processing session did not appeal to my tired eyes. But, if you are considering the purchase of a portable, go and see for yourself.

Data General's achievement with its portable computer is in a way comparable to IBM's with its original PC model. The technology—with the exception of the LCD screen—is proven, off-the-shelf provisioning. What DG has done is make up a package combining a very high degree of PC compatibility, several disk storage options, a capable keyboard, and perhaps most important, added into the mix an established and respected name. You might say that the company immortalized in "The Soul of a New Machine" has brought a little of that soul from the minicomputer to your lap. ■

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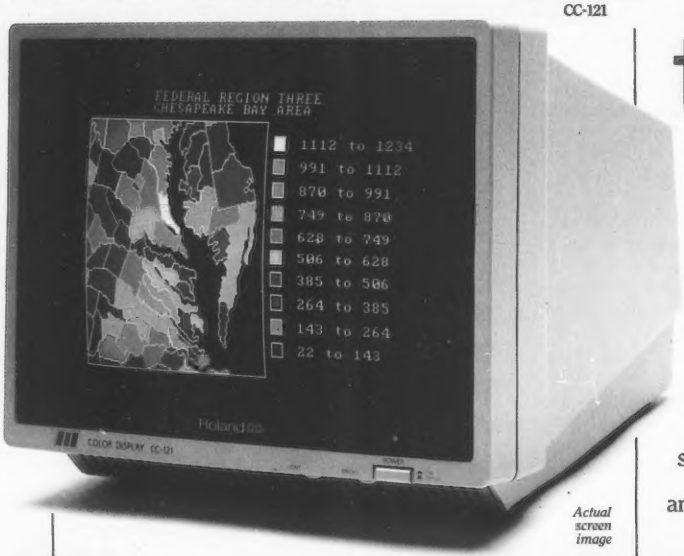
MODEL
CC-121



Actual screen image

Sharper, better, smaller and lower than any of its competitors—you can't buy a more versatile RGB color monitor for your PC than the new Roland DG CC-121.

Roland's sharper image is achieved by a lower dot pitch matrix and a jet-black picture tube for higher contrast. Against the black background, white text really jumps off the screen. (The next best thing to coffee for getting you going in the morning.)

The sharp contrast doesn't hurt the color reproduction either, but then Roland's colors don't really need help. The CC-121's truer, more accurate color reproduction is created by an advanced tube design, and we've even gone to the trouble of adding a special circuit just for the hard-to-do-well color, brown.

All of this performance doesn't take up a lot of valuable desk-top space.

The sleek and slim CC-121 is styled to have one of the smallest footprints of any RGB. Last (and believe it or not least) is the price—$599.00. How is this possible? Because the CC-121 is from Roland DG—the new kid on the computer peripherals block (who's out to make a name for itself by packing innovation, performance, and low price into every product).

R
R
R

decide which white R stands out more, and you'll know why the CC-121's jet-black screen is better

the CC-121 has the smallest footprint on the block

the CC-121's lower price means money in the bank

Ask for the Roland DG CC-121 at fine computer dealers everywhere. Roland DG, 7200 Dominion Circle, Los Angeles, CA 90040 (213) 685-5141.

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Roland DG

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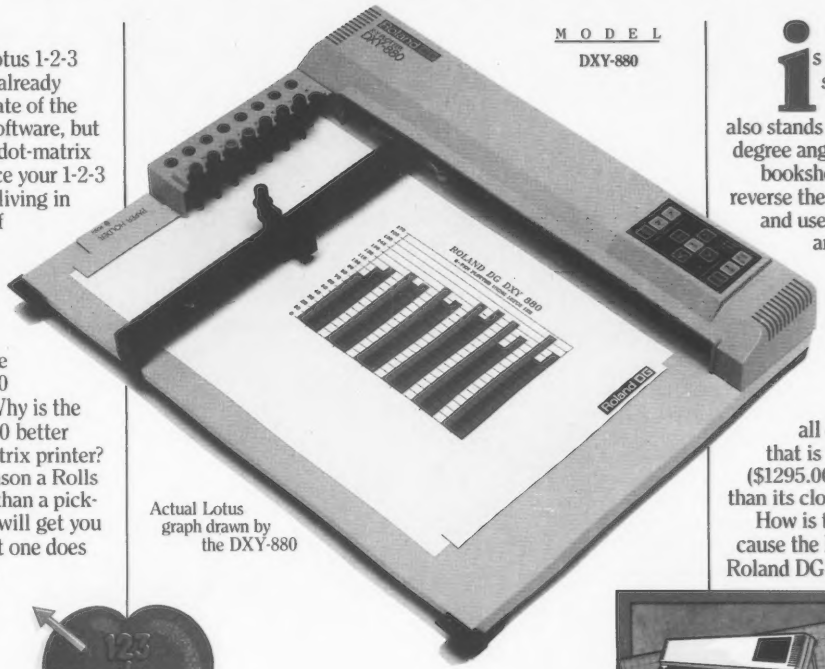
Make 1-2-3 Look Like 1-2-3½

If you're a Lotus 1-2-3 user, you're already using the state of the art in business software, but if you're using a dot-matrix printer to produce your 1-2-3 graphics, you're living in the Stone-Age of computer graphics.

Produce outstanding 1-2-3 business graphics with the Roland DXY-880 8 Pen Plotter. Why is the Roland DXY-880 better than any dot-matrix printer? For the same reason a Rolls Royce is better than a pick-up truck—both will get you to the dance, but one does it with so much more style.

The Roland DXY-880 produces high-quality business graphics in eight different colors on standard 8½" x 11" or 11" x 17" paper, and draws with a lightning quickness and accuracy that can't be matched by any artist. And because the DXY-880 emulates the Hewlett-Packard graphics language, it has at its disposal hundreds of business graphics and CAD/CAM software packages.

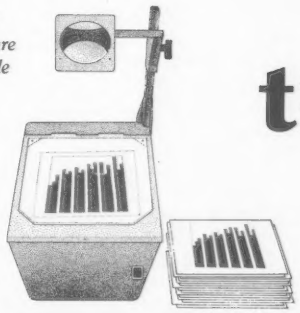
If you do a lot of group presentations, you'll like the fact you can easily produce instant overhead projection graphics just by using acetate instead of paper.



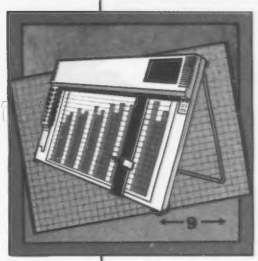
MODEL
DXY-880

Actual Lotus graph drawn by the DXY-880

lotus 1-2-3 and Roland DXY are very compatible



draw your graphics on acetate for instant projection presentation



the DXY can even work on a 9 inch shelf.

Is limited desk-top space a problem? The DXY-880 also stands up to run at a 60 degree angle—perfect for a bookshelf. You can even reverse the plotting process and use the DXY-880 as an input device by activating the built-in multi-speed digitizer. And the best part of all, is that the DXY-880 does all of this for a price that is unbelievably low ($1295.00—hundreds less than its closest competitor). How is this possible? Because the DXY-880 is from Roland DG—the new kid on the computer peripherals block (who's out to make a name for itself by packing innovation, performance, and low-price into every product).

Don't settle for 1-2-3 when you can have 1-2-3½ with a DXY-880 Plotter from Roland DG. Ask for it at fine computer dealers everywhere. Roland DG, 7200 Dominion Circle, Los Angeles, CA 90040 (213) 685 5141.

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Roland DG

CIRCLE 151 ON READER SERVICE CARD

Apple introduces the Fat Mac

512K Mac: Packing The Missing Punch

John J. Anderson

It has been six months now since my initial review of the Macintosh computer appeared in the pages of the July 1984 issue of *Creative Computing*. I received more mail concerning that review than any piece I have ever written. I got letters telling me I was wrong: that the Macintosh was a gimmick, a flash in the pan, and I was foolish to call it a "breakthrough." I got letters telling me I was wrong: that the Macintosh was the greatest thing to happen to computing, and I was foolish to poke holes in such a miraculous development. The fact that readers of both ilks were mad at me was gratifying, at least in one sense: it showed that my point of view was at once suitably awed and suitably critical to offend the extremists at both ends of the spectrum. That pleased me nearly as much as the handful of complimentary notes I received.

My conclusions in that article were neither profound nor heretical. Quite simply, I asserted that the introduction of the Mac did in fact represent a milestone in the history of personal computing, but that the machine had some rather serious problems that could not be overlooked simply because its user interface was so strikingly elegant. My bottom line was that the Apple Macintosh represented a hefty and heady promise of what a computer might one day come to be. The question was, could it make good on that promise?

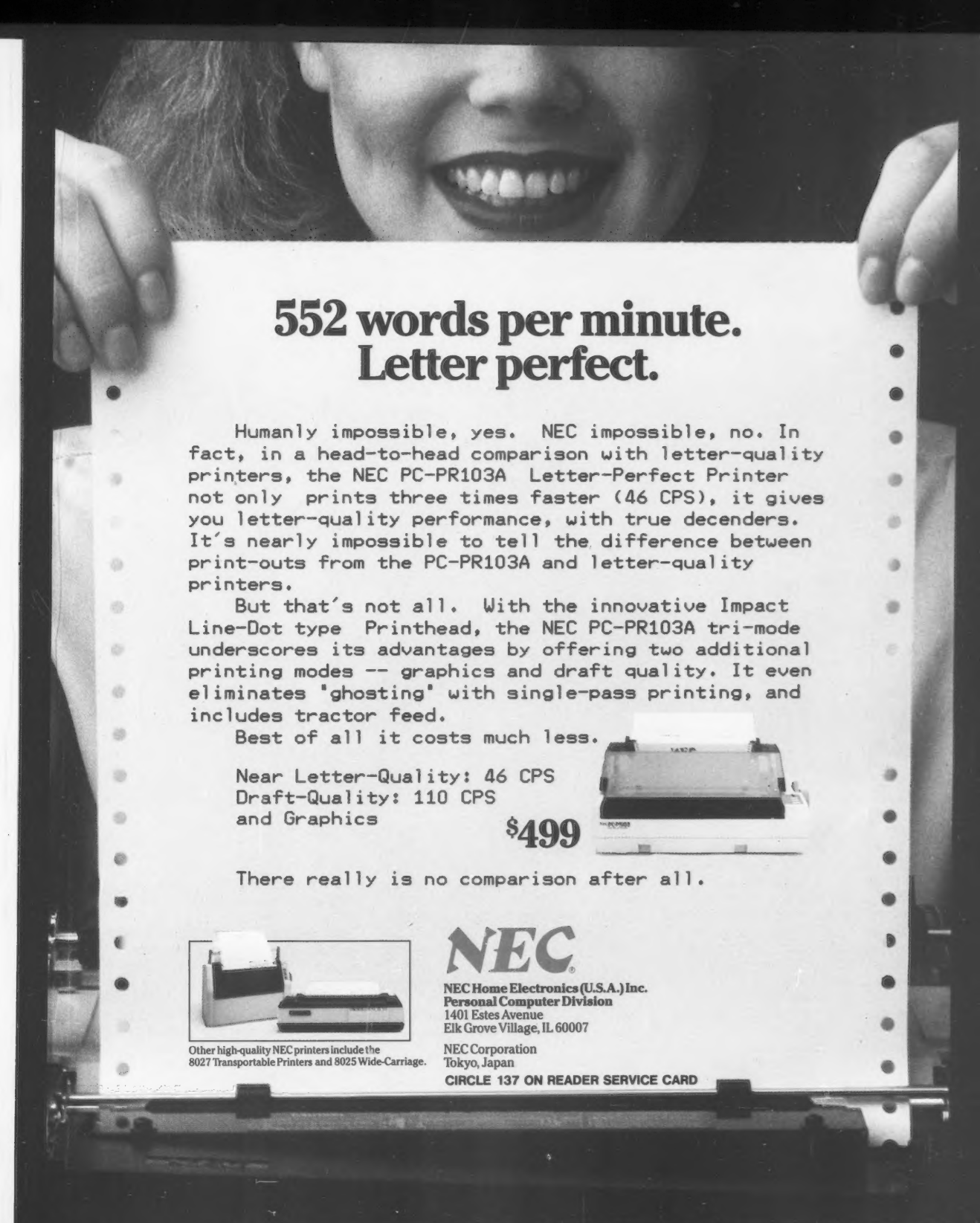
So that question remains today, though we are closer to an answer. But let me make one thing perfectly clear at the outset: I *am* a user. There is a Mac on my desk at work and a Mac on my desk at home. So browbeat me all you like, but don't assume that to show loyalty to a piece of hardware you must not criticize it. Because that's wrong. Remember, we're "the rest of us," right?

It was easy then and it is still easy now to dismiss the Mac out of hand. Thanks to slick campaigns and multi-megabucks, the ballyhoo is still with us—test drive a Mac, or look through a special edition of *Newsweek* with nothing but Apple ads in it. In a way, Apple's California trendiness, laid-back pitch, and open-collar media image may ultimately work against Macintosh sales. When it comes down to business, buyers don't want madras. They want white button-down. In a TV ad for Compaq, John Cleese's impression of a typical Mac buyer hits the dynamic right on the nerve.

The nameplate on the back of this machine is the only visible indication that this is the Fat Mac, not the standard Mac.

Let's take it a step further and dare to suggest that two of the Mac's very hottest features also mitigate against its popularity in the business world: 1) it is too small, cute, and sexy; and 2) it is much too easy to use. I don't have the space here to elaborate on this theory, but those of you who know I'm right will know I'm right. It has to do with the color of your cerebral cortex. Once it turns even the slightest shade of blue, all bets are off.

But the cosmetic issue is far from most significant. The major factor hurting Mac sales in the business market today is the fact that it is "not powerful enough." Fact is the Mac is top-heavy with overhead devoted to its slick user interface, leaving precious little memory for the actual jobs at hand. I stick by my original assertion that the Mac was never a 128K machine on the early drawing board. I would guess that 256K was the target, but the need to lower costs eventually wiped out the option. What was left was an incredibly neat little machine terribly restrained by memory limita-



552 words per minute. Letter perfect.

Humanly impossible, yes. NEC impossible, no. In fact, in a head-to-head comparison with letter-quality printers, the NEC PC-PR103A Letter-Perfect Printer not only prints three times faster (46 CPS), it gives you letter-quality performance, with true decenders. It's nearly impossible to tell the difference between print-outs from the PC-PR103A and letter-quality printers.

But that's not all. With the innovative Impact Line-Dot type Printhead, the NEC PC-PR103A tri-mode underscores its advantages by offering two additional printing modes -- graphics and draft quality. It even eliminates "ghosting" with single-pass printing, and includes tractor feed.

Best of all it costs much less.

Near Letter-Quality: 46 CPS
Draft-Quality: 110 CPS
and Graphics

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There really is no comparison after all.

Other high-quality NEC printers include the 8027 Transportable Printers and 8025 Wide-Carriage.

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CIRCLE 137 ON READER SERVICE CARD

C-PR103A
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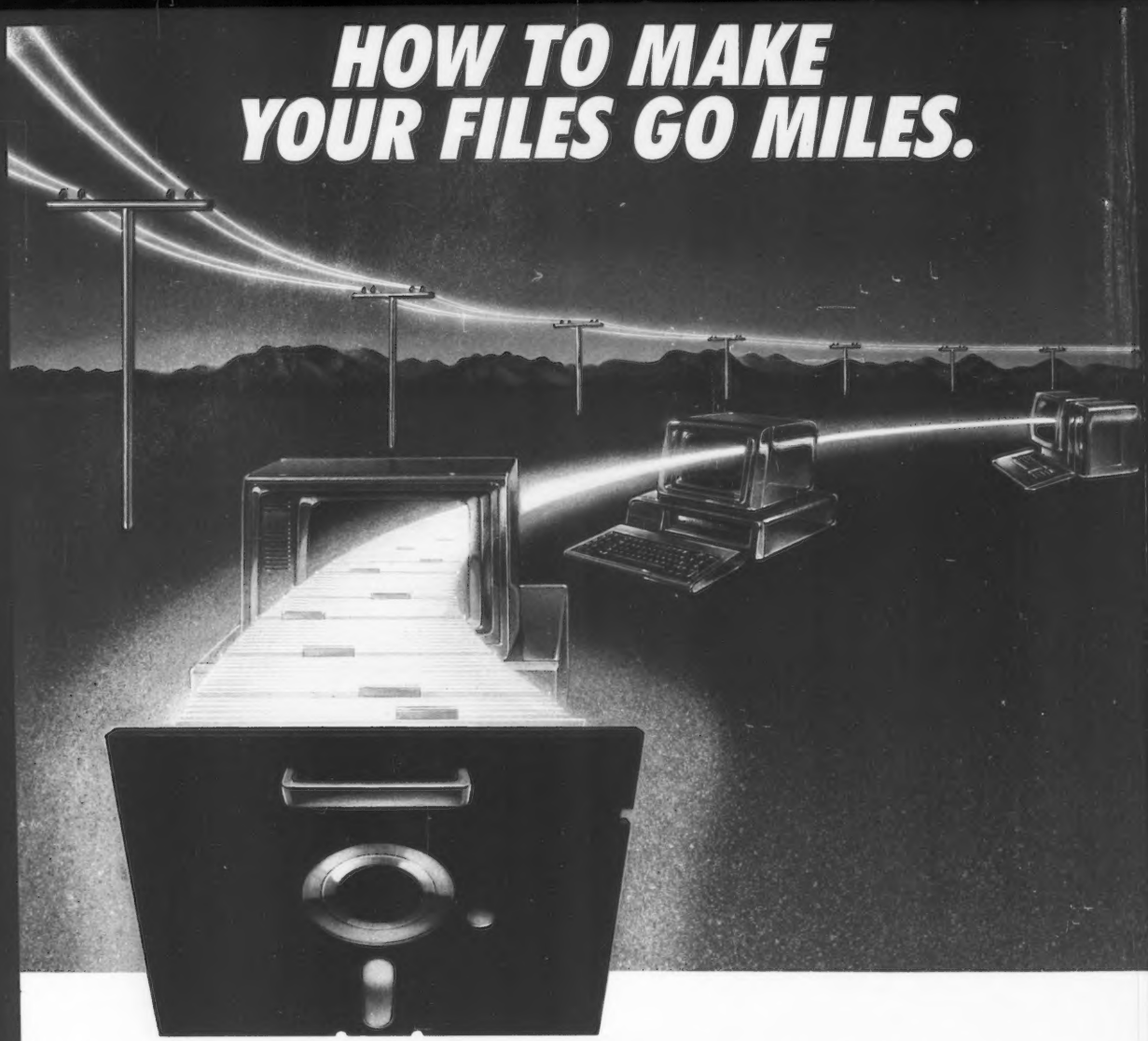

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CIRCLE 211 ON READER SERVICE CARD

tions. This was the most serious flaw I could find in my initial report.

And though some good 128K software has made an appearance for the machine, by and large the Macintosh software scene was rather disappointing in 1984, both in quantity and quality. The cardinal sin in any Mac software trade off is to sacrifice needed features for ease of use, and unfortunately, many Macintosh packages are guilty of that transgression to quite some degree. Many of the programs that are available today in very powerful MS-DOS incarnations have been bowdlerlized in some way, shape, or form in order to bring them to fruition on the 128K Macintosh. I can mention two prime examples: *DB-Master* and *ThinkTank*. Both now run on the Macintosh, albeit in a highly abridged form. In order to release a Macintosh version, both manufacturers traded off features— an undesirable transaction, to say the least.

Now the 512K Mac has hit dealer's shelves and has been dubbed, much to the chagrin of McDonald's, the Fat Mac. The Fat Mac packs its punch into the same mother board as the 128K Mac, with the replacement of 16 memory chips on its lefthand side. This fourfold gain in RAM can also be purchased as a retrofit to existing 128K Macs. The option adds $1000 to the list price of a 128K machine—whether purchased initially or fitted as an upgrade.

The RAM chips themselves are soldered directly to the multilayer motherboard of the Mac, and only as an act of vandalism can be removed with an IC puller. You cannot, therefore, do the upgrade yourself, but must bring the machine to an authorized dealer. In a 15-minute procedure, motherboards are switched. The old board is then reconditioned and itself sold as an upgrade.

Fat Mac units themselves are in short supply, but we managed to lasso a machine. The only hint that it is any different from a standard Mac is its nameplate, and since that nameplate appears on the back of the machine, it is a quiet self-announcement. But when you start using it, the difference is readily apparent.

I'm going to assume here that our readers who use the Mac regularly have purchased a second disk drive, if not a hard disk unit. For them, the bother of disk-swapping is already in the past. So I won't dwell on the improvement 512K makes on a single disk machine. Certainly if I were to be limited to a single disk machine, I would do my best to make that machine a Fat Mac. Because bigger chunks of data can be stored at a time, disk-swapping is cut to a minimum. Even on a dual-drive system, file transfer time is cut dramatically.

But that is a minor advantage of the 512K Macintosh compared to its improvement in computing power. From a maximum of 10 single-spaced pages per document in MacWrite, the same program can yield an 80-page document on the Fat Mac. (A new version of *MacWrite* uses virtual memory techniques to allow 50-page documents on a 128K Mac and 250-page documents on a 512K Mac.) In *MacPaint*, the user interface is now silky smooth while scrolling the page, rather than chopped by sporadic disk loads. In Basic, desktop tools can be called up during program execution without disturbing screen memory or the stack itself. In *MacTerm*, the text buffer is huge. In *Multiplan*, spreadsheet size can be increased dramatically. In other existing software packages, the usable workspace can be quadrupled.

Even more significant, however, is what the Fat Mac can do for software currently under development. Features that would have to be lopped off to make a program run in the 128K can be salvaged—even improved upon—in a 512K environment. It would not be surprising to see two versions of a single product, like Lotus' integrated package or Microsoft *Word*—for which 512K would be required to take full advantage of all features, but a limited version would run on a minimally configured machine. By developing products for the Fat Mac, software houses can subvert the reputation that Mac software sacrifices power for ease of use. We Mac users know that software can do more and be easier to use at the same time.

So: is a Fat Mac or an upgrade for you? The answer to that question is without a doubt a resounding yes. The remaining and real question is *when* will a Fat Mac or upgrade be for you. The upgrade chips themselves, 256K dynamic RAM chips, are still relatively rare and still relatively expensive. I would not be startled if chipset costs were cut in half—to $500 list, or even less—by this time next year. And so you must measure lost convenience across a function of time.

When the next generation Mac appears, it will most probably sport a megabyte of RAM as standard equipment, and 512K will be considered paltry. It's all relative, folks. ■

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Pushing the envelope, or whatever happened to innovation?

Mindset Micro

John J. Anderson

It isn't often I get to write about a microcomputer that has found its way into the Museum of Modern Art. The Mindset microcomputer has managed that rare feat, and in that regard I might only add that its beauty is far more than skin deep. If you are not already aware of it, you are about to learn that the Mindset is, as computers go, quite a work of art.

Why, then, has the Mindset *not* managed to find its way into very many businesses or households? The answer to that is complex. The answer to that tells us something about the microcomputer market today that we may not care to know—certainly not care to trumpet. Personally, I find the answer somewhat disheartening. But it is a fascinating question, so I'll attempt to answer it nonetheless.

I hope your curiosity has been piqued.

Toward a Next Generation

You may or may not have noticed how alike microcomputers have become. They may fit a somewhat broad price category, but as a general rule, tend to look very much like their similarly-priced competitors. Certainly the MS-DOS standard and ensuing clone wars have done much to enforce this bland conformity. But rather than issue my standard broadside on the mediocrity of MS-DOS, I will, simply as a change of pace, give it some due this time around. There has been a need for some standard in the industry, and MS-DOS has helped. Because of MS-DOS, some good things have, in fact, happened: programmers have had an easier time of reaching a larger market base, and the impact of IBM's entry into the microcomputer marketplace has been mitigated.

I'll freely admit that I come from a highly biased, non-IBM background in low-end systems—specifically Atari and Commodore computers. Neither will run MS-DOS, and both are quite similar within their own price category. Both also attempted to follow up on initial success in that price range with next-generation machines that were neither compatible with their own ancestors nor with MS-DOS. And those machines have not fared very well. The only company that has challenged MS-DOS and lived to boast about it is Apple.

As I sit here tapping out these words on a Fat Mac, I can guess it was more a

Museum micro.

Photograph by Jeff MacWright

Hardware Profile

Name: Mindset **Type:** Microcomputer **CPU:** Intel 80186 true 16-bit **RAM:** 128K expandable to 384K **Operating System:** Mindset MS-DOS **Keyboard:** Detached 83-key Selectric-style full-stroke **Display:** 320 x 200 in 16 colors, 640 x 400 in two colors **Ports:** RF, NTSC, RGB, synch, modular cartridge slots, mouse **Dimensions:** 16" x 12.2" x 2.5" with expansion unit, 11 lbs. **Documentation:** Good. Nearly identical to PC documentation in organization, form, and content **Summary:** A superlative graphics box hampered by an ambivalent market place **Price:** $2400 (2 disk drives 256K)

Manufacturer: Mindset Corp.
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matter of hubris than marketing involved in the decision to snub MS-DOS in the Macintosh and Apple II series gameplan. Compatibility today must be presented as a given: the user has evolved a certain right to assume that a body of extant software will run on a given new machine. I believe that the era when a machine could be introduced successfully into the marketplace with a total dearth of software ended abruptly with the Macintosh. And those days will not return.

How, then, does a next-generation machine make its entry into the fray? Can we not pin at least a fraction of the blame for the current doldrums in hardware evolution on this very point? Can we not posit that the trade-off for standardization is a bad case of inertia of rest—of procrastination, and of overall aversion to new ideas?

Atari Alumni

Already it is a little difficult to remember what a giant in the business Atari used to be. A blast from the golden low-end past: because of Atari's involvement with coin-op arcade and dedicated home video games, design recruits had an instilled love of quality graphics and sound. The early Atari computers set a precedent for the sophistication of such capabilities. And around Atari's hardware and software developers, the evolution of same was taken as a given.

Roger Badertscher and Bruce Irvine, both formerly of Atari, had and still retain a ferocious commitment to these capabilities. When Atari fell on hard times, they set off to find the hardware future on their own. And that is where the story of the Mindset begins. But in realistic deference to a maturing market, both realized that any new machine, even a next-generation graphics box, *must* offer MS-DOS compatibility. In early 1984 they began shipping a machine that was soon to earn itself a pedestal in the Museum of Modern Art.

Blend, not Bland

The Mindset is no mere clone. It is a next-generation micro that also offers MS-DOS compatibility. Based on the Intel 80186 processor, it offers 8088 compatibility at a better clock speed (6 MHz as opposed to 4.77). Mindset disk drives can read from and write to IBM-format disks.

Added to this improved 16-bit processor are two custom VLSI chips designed by Mindset in cooperation with VLSI Technology Inc. These take much of the processing load of graphics chores off the CPU, freeing it for the real work at hand.

At one time the Mindset was envisioned as a modular system which would allow a buyer to opt for a broad range of configurations. By and large these distinctions have been erased with the passage of time and the impact of the Mindset on the market (or of the market on the Mindset, if you care to view it that way). The system we received sported 128K RAM, two single sided, double density 5.25" drives, and serial/parallel interface modules. I don't see how a user could get by with much less than this nowadays, and assume that this is the target configuration toward which the Mindset is currently aimed.

And a Real Looker

While we're on the topic of modularity, let's get our look at the cosmetic side of the Mindset out of the way. The Mindset is not exactly the most beautiful piece of hardware you've ever laid eyes upon. But in terms of the maxim "form follows function," it is a winner.

Super Graphics Driver: Lumena

Once upon a time there was a need to bring the power of graphics systems costing $20,000 and more down to the level of the $3000 microcomputer. Enter the Mindset, and enter *Lumena*, a piece of graphics software that is truly impressive. *Lumena* turns the Mindset into an unmatched color graphics machine.

Designed for best use with a graphics tablet, we had to get by with the mouse as input device, and though the mouse is not a great drawing tool, we were still able to get the "feel" of *Lumena*. *Lumena* allows you to design, store, and retrieve graphics screens that take full advantage of the color, resolution, and animation power of the Mindset computer. It packs more than 100 powerful graphics commands into a point-and-click, menu-based palette that toggles onto the lower third of the display. And though it does not work as smoothly nor as intuitively as *MacPaint*, *Lumena* is quite similar in terms of its user interface, while incorporating a major difference: the results are in vivid multicolors.

Lumena landscape.

In addition to the usual complement of graphics commands, *Lumena* has some tricks that can be found only in professional level minicomputer-based software, including scale and rotation commands, and sophisticated animation tools. In addition to a very easy-to-use "animation paintbrush" function, *Lumena* can handle animation not only through color cycling but in a cell-based method, wherein you store images in the Mindset frame buffer for fast and individual transfer to the display screen. Combined with conventional disk storage, dynamic use of the cell buffer can result in very effective animation effects.

It takes some time to get comfortable with the *Lumena* program, and the manual is very terse. Learning the nested tree-structure takes time and is not a casual process. Some features actually seem to work counterintuitively, you might say. We are not quite sure what the reasons are for this. But as a graphics tool, *Lumena* is very impressive. And once you sit down with it for a few minutes, you tend to get hooked.—*JJA*

Software Profile

Name: Lumena **Type:** Graphics development system **System:** Mindset computer
Format: Disk **Summary:** An excellent taste of big graphics power in a small space
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Manufacturer: Time Arts, Inc.
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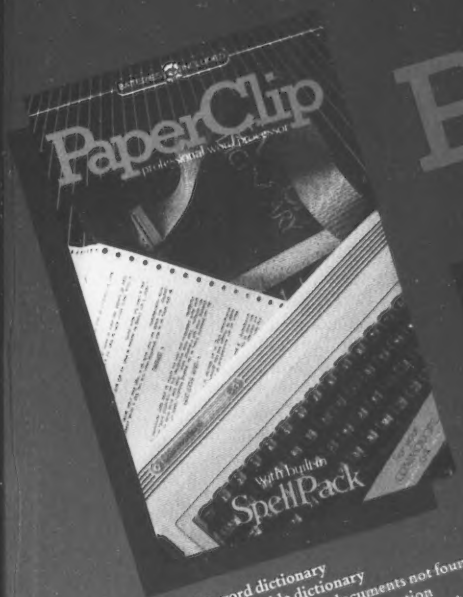

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The disk drive/memory expansion box is itself modular and plugs into the top of the low-slung, powder white system unit through an internal bus connector. This forms the Mindset into a sleek, attractive double-decker shape. Parallel and serial interfaces are modular, as are memory expansion boards, enclosed in their own plastic cartridges. The front of the unit features two ROM cartridge slots with dummy carts plugging access as an added cosmetic feature. On the side of the unit is a ROM cart lock to ensure that the user won't pull out a cart at the wrong time.

The Keyboard

The detachable keyboard of the Mindset is an 83-key fullstroke keyboard, laid out in true Selectric style. The 10 function keys run across the top, where they belong, and in place of a numeric keypad, cursor and dedicated function keys appear in that familiar 3 x 4 key matrix to the right of the qwerty keyboard.

The system power switch resides on the back of the keyboard unit—a very convenient design feature. The switch is placed in such a manner that accidental power-off is not an issue, and yet you don't have to reach around the side of the system unit to turn the machine off or on. The joystick/mouse ports are on the sides of the keyboard unit—a further convenience.

The mechanical mouse that came with our evaluation Mindset was a two-button model with a heavy black cable and metal ball. The heavy cable was a chore to work around, and the uncoated metal ball inside the mouse scraped the desktop like a fingernail on a blackboard. Still, we found the mouse to be accurate and useful working with the software package *Lumena* (see accompanying review).

A mention should be made of the ROM cartridge slots of the Mindset and the original plans the manufacturer had for them. Originally Mindset GW-Basic, with a strong emphasis on color graphic and animation commands, was slated for ROM manufacture. The system manual also makes mention of non-volatile RAM cartridges planned for the cartridge slots. This CMOS RAM would be maintained by its own internal battery power between AC sessions. I'm sure the maker also had in mind the possibility of games and other computer languages to be available on ROM.

However, perhaps because the Mindset has failed to set the industry on fire, our version of GW-Basic arrived on disk rather than ROM. It seems unlikely to me that new ROM software is likely to appear for the machine, let along costly CMOS RAM cartridges. And it's a shame. The RAM cartridge is a concept still quite ahead of its time.

Mindset GW-Basic

If you are a Basic programmer and you especially enjoy graphics and sound programming, you will not find a richer or more conducive environment than GW-Basic on the Mindset microcomputer. Microsoft, in its implementation of the language for the Mindset, has added an impressive and powerful list of dedicated graphics and sound commands to the standard Basic vocabulary.

In the realm of still graphics, commands such as CIRCLE, COLOR, DEF, OBJECT, DRAW, GET and PUT, PAINT, PALETTE, POINT, and SCREEN simplify input of geometric shapes.

Mindset GW-Basic simplifies the task of programming animation by performing many routine tasks automatically. For example, as an object moves across the screen, GW-Basic can save the background patterns as they are obscured by the object. As the background is uncovered behind the object, the original background patterns are replaced. Other animation features of the language include programmable motion and viewing priority, multiple views of an object, statements that control animation events, collisions, etc.

Animation commands include ACTIVATE, ARRIVAL, CLIP, COLLISION, DEACTIVATE, DIM OBJECT, ON ARRIVAL, ON CLIP, ON COLLISION, START OBJECT, and STOP OBJECT.

As for sound, the Mindset is not quite state-of-the-art, as it seems to be with Basic animation. It can generate pure tone across six octaves in four voices. It is unclear whether envelope-shaping is possible outside of assembly language—it is not handled from GW-Basic in either case. Sound commands that are present include BEEP, PLAY, and SOUND, which allow for simple music and pure tone sound effects.

The system documentation speaks of stereo output using an add-on module; I assume this means the onboard sound would then become one channel as the add-on module became the other, for a total of eight voices. In my opinion this option is not now likely to make an appearance, unless the Mindset receives the kind of rejuvenation that pick-up by Atari might generate.
—JJA

Graphics Box

To pinch the term of former editor Ted Nelson, the Mindset computer has been designed first and foremost as a "graphics box," and on this account is very impressive indeed. It sports a resolution of 320 x 200 pixels in 16 colors, or 640 x 400 pixels in two colors. Three outputs offer total flexibility: RF for conventional television, NTSC monitor, and RGB monitor jacks are standard. Certainly for maximum quality, an RGB monitor is indicated.

Of the 11 graphics modes available on the Mindset, the very hi-res modes make use of interlaced scan, which shortcuts screen refresh ingeniously to improve signal quality. Unfortunately the best of these modes must be supported by a custom Mindset monitor, which may be quite a rarity by the time you read this. However interlaced scan and other techniques are employed by the custom chips to provide color graphics that far outstrip the competition, even on a stock RGB monitor.

And it is very important to note further that Mindset graphics are not restricted to the static variety. The Mindset is capable of handling animation of a new level of sophistication for the price. Impressive animated effects can be created by the user simply by rotating through color registers—or through the use of the standard built-in 32K frame buffer, which can switch between two entire screens instantly. According to the manufacturer, the VLSI chips speed graphics operations by up to 50 times that of the IBM PC.

The Lost City

You might imagine what this kind of graphics power could do for the creative programmer (see sidebar). One such programmer, and a very talented one, was Kelly Jones, of Synapse Software. His team got hold of a prototype Mindset and were stunned by its capabilities. One result of their efforts was City,

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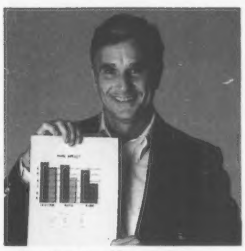

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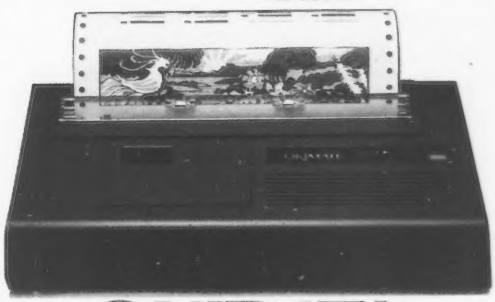

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an arcade game that depicted low-altitude flight over a city—in smooth, multicolor, real-time animation. Everyone lucky enough to have seen the program went ape over it. Finally, it seemed the goal had been reached: graphics rivaling dedicated arcade games possible on a personal computer.

But I have never seen City, and at press time had still not been supplied with even a prototype or demo copy of the program. The reasons for this tie in with the question I posed up top about the fate of the Mindset and the fate of innovative machines in the industry as a whole.

To coin a term that also epitomizes Ted, the marketplace has "matured," and in its maturation process it has lost much of its original spark, innovation, and imagination. Today supposed graphics "experts" think of graphics in terms of when to use a pie chart as opposed to a bar chart. Today a program like City had better run on the Commodore 64, or else be capable of charting the cost of equity capital. Today the idea of designing machines that push the envelope of graphics price/performance has caved in to the design of machines that are compatible but cheaper. It is a shift in emphasis that makes the micro world a colder place for those who are motivated enough to seek something more.

There was a rumor afloat not too long ago that with the accession of Jack Tramiel, the Mindset was under consideration to join the next generation of Atari micros. The unit would not look too bad alongside a range of new micros, and certainly fits the description (see upcoming issues). One might imagine that such an arrangement could only benefit the marketing, advertising, and distribution of the Mindset—areas that have suffered in the past.

Compatibility Caveat

I must add my now-standard disclaimer, which has evolved over the series of so-called "compatible" reviews I have amassed recently. I have yet to see a compatible that was truly 100% compatible. The point I try to emphasize is that it is *not* really a question of how compatible a given machine is: 90, 80 or 40%. The real question is: will a given compatible run the programs *you* want to run? Make sure you answer this question before you buy.

I found that the Mindset would boot just about anything out of its version of MS-DOS, with the exception of some programs in extended Basic. *Wordstar* ran without problems. However, no protected programs would boot from cold start or out of MS-DOS. I could not try *Lotus* as we were supplied with a 128K machine. So if it is games compatibility you are after, the Mindset is not your machine. If you need to run copy-protected programs, the Mindset is not your machine.

If, on the other hand, it is a creativity machine you want, the Mindset is something you can truly get lost in. I only wish developers had the chance to cash in on its power. ■

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What do you get when you cross 1200 baud, free on-line time, and extra features at a price Hayes can't match?

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CIRCLE 209 ON READER SERVICE CARD

INTRODUCING THE NEC ADVANCED PERSONAL COMPUTER III. AND EIGHT REASONS WHY IT'S SO ADVANCED.

ALL OF THE PROGRAMS YOU NEED TO RUN YOUR BUSINESS WILL RUN ON THE ADVANCED PERSONAL COMPUTER III.

1. Performance. The NEC Advanced Personal Computer III is designed for speed. In fact you can't buy anything faster for the money. What it means to you is significant savings in time. On any program. From spreadsheets to complex graphics.

2. Software Solutions. Since it runs MS™-DOS, you'll find specific applications packages for most small businesses and professions.

You can also run many office productivity programs to help you with everything from word processing to graphic presentations.

3. Easy-to-Use. It was also designed to be exceptionally easy to use.

It comes with a 14-inch monitor with a tilt and swivel base. Which is one of the largest and easiest to view screens of any PC.

The keyboard is low-profile and has a typewriter layout. Which speeds up data entry. There's also a "Help" key to guide you.

4. Expandibility. This PC is truly modular, so it can grow with your needs. You can start with the least expensive diskette system, and move all the way up to one with hard disk and PC-UX,™ our UNIX™-III based operating system.

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NEC ALSO MAKES THE HIGHLY-RELIABLE SPINWRITER LINE OF LETTER-QUALITY PRINTERS.

6. Quality. The Advanced Personal Computer III is designed and manufactured entirely by NEC. Which makes it the only personal computer to have one name on every component.

NEC also makes the popular Spinwriter™ family of letter-quality printers, which are legendary for their reliability.

7. Support. The Advanced Personal Computer III comes with the commitment of a $7 billion worldwide company. If you ever need support or service for hardware or software just ask your NEC–trained dealer.

YOU'RE LOOKING AT THE SHARPEST COLOR SCREEN OF ANY PC.

8. Price. NEC is able to give you all these advancements for quite a bit less money than other personal computers. Which just may be the advancement you'll appreciate the most. To find out more about the NEC Advanced Personal Computer III, just call 1-800-343-4418 (in Mass. call 617-264-8635) for the name of your local dealer. NEC Information Systems, Dept. 1610, 1414 Massachusetts Ave., Boxborough MA 01719.

NEC

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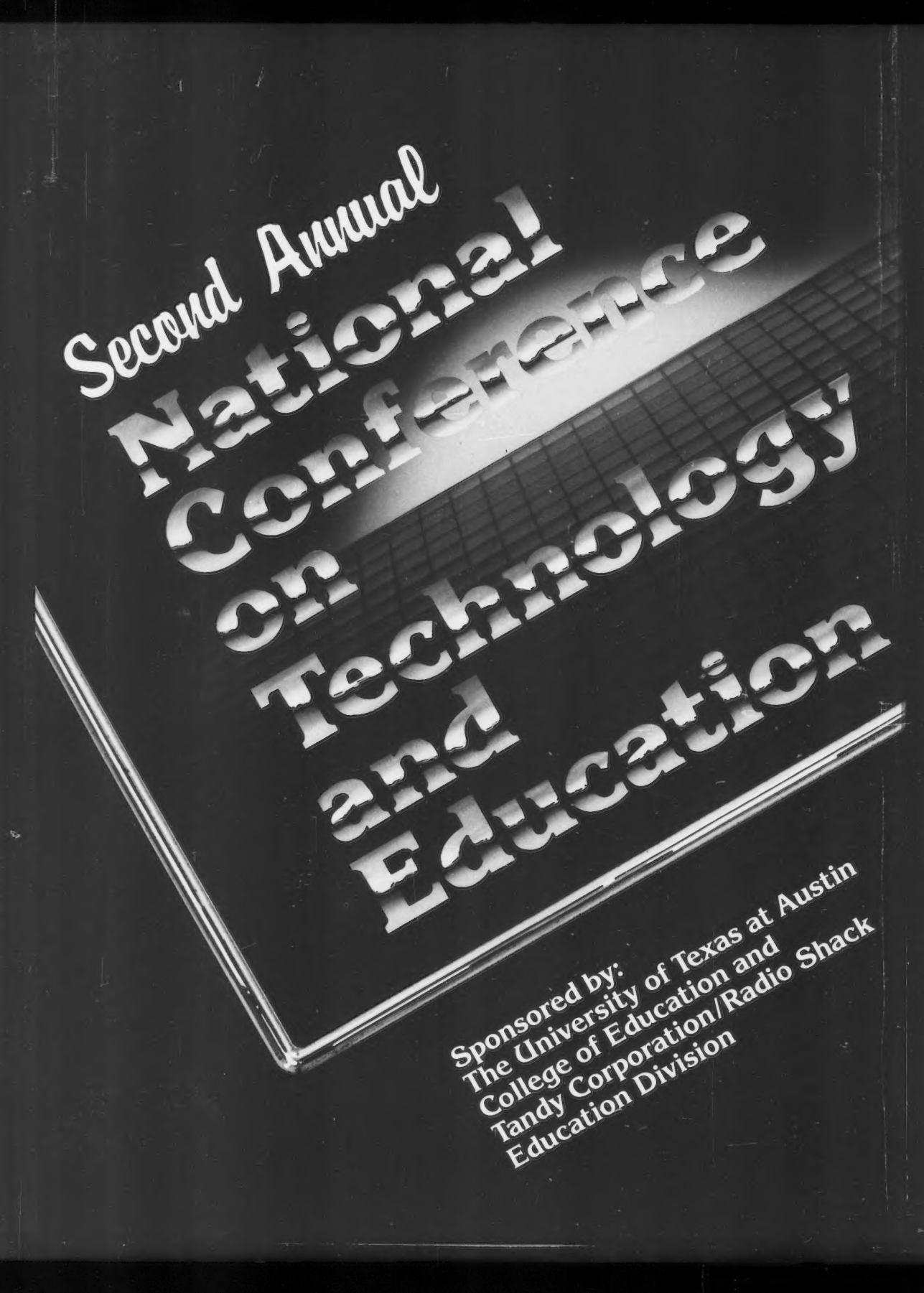
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Discover the impact of new technologies on the classroom. The second annual National Conference on Technology and Education will be held March 6-7, 1985, in Fort Worth, Texas. The two-day conference is co-sponsored by the University of Texas at Austin College of Education and Tandy Corporation/Radio Shack Education Division. The conference will again offer educational decision makers a forum to explore applications of computer technology, as well as the potential benefits and problems of computer usage in education.

Featured keynote speakers will include J.C.R. Licklighter, Professor of Computer Science, Massachusetts Institute of Technology; Vern Cunningham, Professor of Education Administration, Ohio State University; Jack Taub, President, National Information Utilities Corp.; Michael Sullivan, Maryland State Assistant Superintendent of Schools; Billy Reagan, Superintendent of Houston, Texas, Schools; Paul Salmon, Executive Director, American Association of School Administrators; and Dr. Hans Mark, Chancellor of the University of Texas System.

Breakout session speakers who will address timely topics include Bill Gibbons, HOSTS; Ken Komoski, Educational Products Information Exchange; Ken Brumbaugh, Minnesota Educational Computing Corporation; Teresa Middleton, SRI International; Dr. Sylvia Charp, T.H.E. Journal; Richard Young, Houghton Mifflin; Richard Carroll, Allyn and Bacon; Dr. Carl Candoli, Fort Worth, Texas, Public Schools; Arthur Luehrmann of Computer Literacy and more.

Sessions will focus on educational courseware, classroom networking, hardware and software purchasing considerations, computer curriculum planning, administrative courseware and teacher training, robotics, artificial intelligence and more.

To those who request it, a Continuing Education Credit Unit of 2.0 hours will be granted by the University of Texas College of Education upon completion of the conference. Those who wish, and whose districts approve, may receive in-service training credits for attendance. (An additional fee is required to receive CEUs.)

Take advantage of this unique opportunity. Plan to attend the second annual National Conference on Technology and Education in Fort Worth, on March 6-7, 1985. Registration fee is $95. Attendance is limited, so register today.

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To receive more information and registration materials, mail this completed form to:

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NEC's PC with style

NEC APC III

Corey Sandler

Japan's NEC has taken the good, gray flannel IBM PC and given it a touch of style, a splash of color, and a burst of speed. They've packed it in a neat little case and called it the NEC APCIII.

Almost all of what NEC has done can be considered improvements, unless your particular need demands total hardware and software compatibility with the IBM PC original. NEC's marketing plans call for the company's logo to appear on every possible piece of hardware it can sell, from keyboard to microprocessor to disk drives to monitor to printer.

The first thing you notice on sitting down before the APCIII is likely to be its "style." The system unit itself is a tidy little box of roughly two-thirds the dimensions of the IBM model. Next there is the optional color RGB monitor, its jet black tube encased in an attractive brown frame and mounted on an infinitely adjustable swivel. And then once the system is turned on, the eyes are treated to an exceptionally sharp color screen with a finely chiseled character set.

That color display is presented in as many as eight colors at a high-resolution setting of 640 by 400 pixels, double the potential resolution of the IBM PC standard color/graphics adapter. The keyboard, though blessed with a generous 102 keys, has a few idiosyncrasies that may take a bit of getting used to.

The APCIII can be described as a "data compatible" machine. In general, it can be counted upon to read from files created on an IBM PC, and produce files that can be used on that machine. It does require, though, its own versions of many programs and programming languages. And, under the hood, the NEC uses its own system bus—for the moment, you are limited to NEC adapter cards, NEC monitors, and NEC-authorized disk drives.

In general, programs written to run under MS-DOS should work on the

NEC's Advanced Personal Computer offers a 640 x 400 high-resolution display with up to eight colors.

Hardware Profile

Name: NEC APCIII Computer **Type:** Desktop **CPU:** 16-Bit 8086 8 MHz **RAM:** 128K (Expandable to 640K) **ROM:** 32K **Operating System:** MS-DOS **Keyboard:** Detachable, 102 keys, slant adjustable **Display Resolution:** 25 x 80 characters, 640 x 400 pixels **Ports:** Centronics parallel, RS-232C serial **Dimensions/Wt:** System unit: 16.5" x 5.9" x 13.6". Keyboard: 18.5" x 1.6" x 7.7" **Documentation:** Four loose-leaf manuals **Summary:** Impressive desktop from Japan's largest computer manufacturer **Price:** Base price $1995.

Manufacturer: NEC Information Systems, Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000

Photographs by Jeff MacWright

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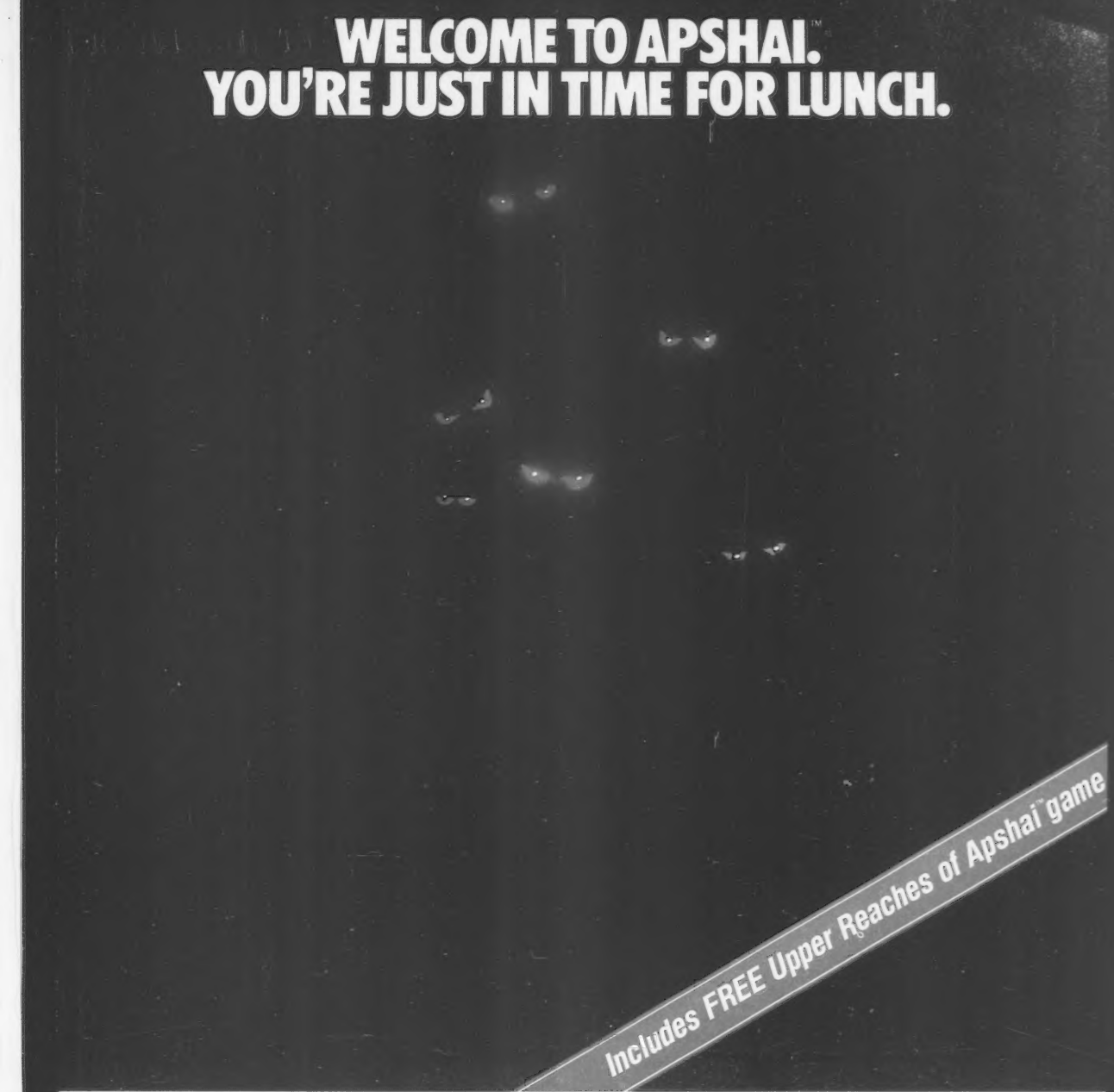
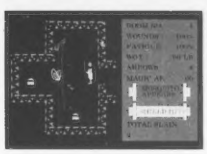


Includes FREE Upper Reaches of Apshai™ game



Boy, have you taken a wrong turn. One moment you're gathering treasure and the next you're being eyed like a side of beef.

You're in the world famous Temple of Apshai,™ the award-winning computer game that has set the standard by which other role-playing adventure games are judged.

Unlike other adventure games, your character grows stronger and more intelligent as you gain experience. You can even save your favorite character to use him in future adventures. And that might be a smart move, since it will take many tries to master the four different levels with over 200 rooms and collect the countless treasures, weapons, potions and spells scattered throughout. Along the way, you'd better watch your step—there are over 20 different types of monsters lurking about with hungry looks on their faces, all planning to make you their next meal.

If you think it sounds challenging, you haven't seen anything yet. With every Temple of Apshai* we will be including absolutely FREE "Upper Reaches of Apshai" with four more levels, another 150 chambers and of course, a fresh supply of hungry monsters. That's enough of a challenge to keep even the most experienced game player busy for months, maybe even years.

Available at your local retailer for the Apple, Atari, Commodore 64, and IBM home computers.

*Offer applies to specially marked boxes and is available in disk format only.

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Strategy Games for the Action-Game Player

CIRCLE 124 ON READER SERVICE CARD

NEC machine; programs written under PC-DOS and optimized to access system BIOS directly and hardware designed for the IBM PC will have difficulty. For example, I was unable to use an IBM version of *WordStar* on the NEC, or the NEC's program on an IBM. However, data files on disk created with either version of the program could be readily moved back and forth between the two machines.

NEC has announced versions of many of the heavyweights of business software, including *WordStar, MultiPlan, dBase II, Supercalc 3, PFS:File, PFS:Graph, PFS:Report, DR Graph, DR Draw, BPS Business Graphics, BPI Accounting,* and the Microsoft Basic compiler.

The APCIII is built around the 8086-2 microprocessor, a true 16-bit device running 8 MHz. This makes the APCIII a close cousin to the IBM PC, which uses the 8088 (a hybrid 16/8 bit chip) at a speed of 4.77 MHz. We put the APCIII to the *Creative Computing* Benchmark test (see July 1984), a measure of computational speed and accuracy. The result was a zippy 8.5 seconds for the random number test, with an accuracy rating of 0.0058599375. This is nearly three times as fast (and twice as accurate) as the score turned in by the IBM PC (24 seconds and 0.01159668). The APC scored within fractions of several other 8086 machines, including the Stearns Micro, the Tandy Model 2000, and the Eagle 1600.

The motherboard includes an open socket for an 8087 coprocessor chip, which should add jet power to the computer for computational tasks and graphics. A NEC spokesman, though, said that 8 MHz versions of the 8087 chip are not expected to be available until sometime later this year.

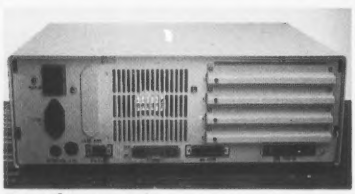
Another measure of speed could be seen in using the machine with the NEC-optimized version of *WordStar*. The cursor zipped from top to bottom of a long file at speeds approaching the same three-times advantage seen in the computing test. The installation program from Micropro, by the way, allows you to select as many as four colors for on-screen display—I used light blue for text, violet for highlighting and screen messages, dark blue for function key names, and red for function key labels. Trust me, it was a work of art.

The standards for video display have been advanced with each new generation of machines using the IBM standard. IBM's original PC offered a medium resolution screen of 320 by 200 picture elements (pixels), with as many as four colors on display. IBM's high resolution screen offered 640 by 200 pixels and a single color for the foreground.

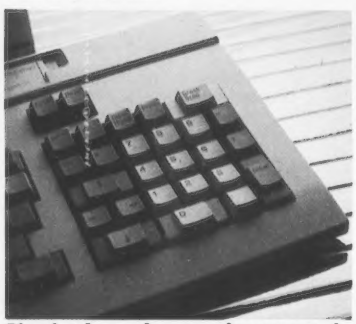
NEC's prices average 10 to 15 percent below IBM's list prices before discounts on either system.

NEC has more than doubled the stakes all around, offering a high-resolution screen of 640 by 400 pixels and one, four, or eight colors on display. The medium-resolution mode offers four or eight colors at 320 by 200 pixels. Be aware, though, that the applications software you purchase for use with the NEC or other high-performance machine may or may not take advantage of the advanced capabilities of the computer.

Although I was quite impressed with the sharpness of the NEC monitor, I did notice a pronounced "pulling" of the video image so that the left border of a row of text was decidely bow-legged. And the block cursor has no clearance between its position and the next character, sometimes making it difficult to read letters at the cursor position.



Rear of system unit.



Directional cursor keys complement numeric keypad.

The APCIII includes a serial and a parallel port, color and monochrome display outputs, and a battery-backed clock/calendar. There is room for four expansion boards in a card cage that can be reached through plates on the rear of the machine. The cover does not have to be removed for installation of most options.

NEC's prices average 10 to 15 percent below IBM's list prices before discounts on either system. A basic system of 128K RAM, one 360K disk drive, a high-resolution monochrome monitor, MS-DOS, and GW Basic has a list price of $1995. The RGB color version of the same system lists for $2295. A second disk drive for either system costs $400 additional.

Although both standard NEC machines include RGB color output, a separate color/graphics adapter board with a list price of $200 is required for display of graphics screens. Additional memory cards are available for $325 with 128K on board and room for another 128K. A joystick/sound board lists for $79.

(IBM PCs now come standard with 256K of RAM. A single-drive PC with monochrome monitor and adapter with parallel port, a serial port, and DOS had a list price of $2685 in November. A color version with RGB monitor was offered for $3038 at IBM Product Centers. Second drives were offered at $425 extra. For comparison with the NEC prices, be sure to add $325 to the APCIII for an additional 128K of RAM. If you will be using games or advanced graphics programs, add another $200 to the NEC price for the color/graphics board).

NEC also offers a hard disk version of its system, with an internal 10Mb drive adding $1700 to base prices. A GPIB (General Purpose Interface Bus) card, which adds a standard IEEE-488 interface for connection to measuring equipment and other devices, lists for $299, and a Unix Memory Management Board is also priced at $299. The Unix board is aimed for multi-user environments to keep concurrent tasks from colliding. The board includes another 8086 microprocessor that actually takes over control of the internal bus. NEC sells PC/UX software (a System 3 derivative) for $700 for the APCIII.

The monochrome version of the NEC system produces resolution of 640 by 400 pixels, which compares favorably with the 720 by 350 display of IBM's

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CIRCLE 125 ON READER SERVICE CARD

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proprietary monochrome adapter and monitor.

"This is not a clone," said Jonathan Joseph, product marketing specialist at NEC Information Systems, the U.S. marketing arm of the Japanese firm. "Our target is the small business with need of packaged solutions." Also targetted, he said, would be users of graphics-oriented systems, including engineers, designers, and CAD/CAM manufacturers.

Among the packages NEC will offer are bundles including several different NEC printers, part of a marketing and manufacturing strategy that stresses a uniform source for hardware. NEC manufactures its own 8086-2 microprocessors under license from Intel, and many of the other internal parts are also from the parent company. The half-height floppy disk in early models is supplied by Teac; according to Joseph, drives from NEC will be substituted in 1985. The hard disk option for the computer is made by NEC.

This concentration on vertical integration can also work to the disadvantage of some users. For example, the PRINTER and SETCOM utilities included by NEC in its supplement to MS-DOS, are aimed at NEC printers—models by other manufacturers are supported only if they happen to match the protocols of a NEC device.

Similarly, the printer installation menu of the NEC version of *WordStar* is heavily weighted toward NEC's machines. I would suggest any purchaser ask to see "foreign" printers working with the APCIII computer before a purchase is made. And, as noted, you cannot plug an IBM or third-party IBM-compatible memory or special purpose adaptor into the NEC system.

The keyboard has a professional, firm touch, somewhere between the click-clack of the IBM PC and the soggy marshmallow effect of some other boards. If the board is too quiet, NEC includes a utility called KEYCLICK that adds a muted beep with each signal sent to the computer—personally, I'd prefer a tooth extraction without anaesthetic to a beeping keyboard, but to each his own.

In keeping with the tradition of the quirky IBM PC keyboard, NEC has made some unusual choices in its design. The biggest problem I found was with the placement of a tiny Caps Lock key between the A and the tiny Ctrl key on the left side of the board. I was writing this review with the aid of *WordStar*, which requires a lot of Ctrl-punching, and I don't think I once hit the key on the first try in three days of work.

The Return key is only one row high, making possible to miss the pad with a hit above or below target. The board includes two graphics shift keys—Grph1 and Grph2—for extended ASCII character codes. The keys, though, sit next to the spacebar and just below the slim Shift key, and again I found myself giving false codes regularly.

Also a bit disconcerting was the design of the cursor pad, a block of 25 keys on the right side of the board. The directional arrows are clustered very tightly together, with the up and down arrows double-wide, and the left and right arrows single key sized. Insert and Delete are stacked above, with PgDn and PgUp sitting in a separate row at the top of the board. I'm sure I could get used to almost any arrangement of keys on a keyboard, but I have to believe there are more efficient designs than the one used on this computer.

The keyboard has a professional, firm touch, somewhere between the click-clack of the IBM PC and the soggy marshmallow effect of some other boards.

The 12 function keys are arrayed across the top of the board. NEC allows each of the keys to be defined in five ways—standard, shifted, Ctrl, Alt, and Fnc shifts—for a total of 60 possibilities. Helping out is a strip at the top edge which can hold a cardboard strip with function key labels.

Interestingly, *WordStar*, as delivered by MicroPro, has all 12 keys assigned—the additions to the standard 10 are Ctrl-K-D (Save and exit to menu), and Ctrl-K-S, Ctrl-Q-P (Save and return to text at the same cursor position). However, only the first 10 keys are displayed on screen. In Basic only six keys are displayed.

NEC provides Microsoft's MS-DOS 2.11, GW-Basic 2.01, and the GSX graphics extension software, together with reference manuals and a macro assembler package. MS-DOS 2.11 is roughly equivalent to IBM PC-DOS 2.1, and GW-Basic is equivalent to IBM BasicA version 2.0. IBM has added a few commands and statements of its own to its offering, and NEC has matched many of them with its own custom set of commands.

For example, NEC's version of MS-DOS has an equivalent of IBM's DOS 3.0 ATTRIB command. Using the NEC, the CHATT command can be used to set a file attribute to read only, system, hidden, or archive status. The following are some other NEC additions to MS-DOS:

- COLOR GREEN or COLOR WHITE sets the default screen color for color monitor or the grey-tone intensity for monochrome monitor.
- CTRDUMP is an equivalent of the IBM's PrtSc for text and the GRAPHICS add-on to DOS for graphics screen prints. However, NEC has customized this command to dump to the NEC Pinwriter P2-3 and P3-3 printers only.
- DISKCOMP is an equivalent to IBM's proprietary command of the same name.
- KEY allows reprogramming of the keyboard, including function keys.
- MOUSE configures the GSX device driver to accept input from a mouse. It sets serial port baud rate and communications protocol for the Microsoft, Mouse Systems, or Summagraphics device.
- PRINTER configures standard default PRN device from among six NEC printers.
- RAMDISK sets up electronic disks of 128, 256, 384, or 512K in size.
- SETCOM is used to declare communications protocols in a manner similar to IBM's MODE command.

As Japan's largest maker of desktop computers (70% share), NEC must be doing many things right. The APCIII is their latest entry in the U.S.

I was impressed with the performance of the APCIII—evident in both computational speed and running applications software—as well as its solid design and construction. The color display is outstanding, and much of the software can be customized to take advantage of that color.

I found some quirks in the keyboard layout and would have liked to see the software utility programs support more than just the NEC printers. These are minor quibbles, however, against the overall excellence of the unit. If your computing requirements can be met by the software available for the APCIII, I recommend that you give it serious consideration. ■

CIRCLE **403** ON READER SERVICE CARD

INTRODUCING COMPUTER ACTIVITY TOYS™...

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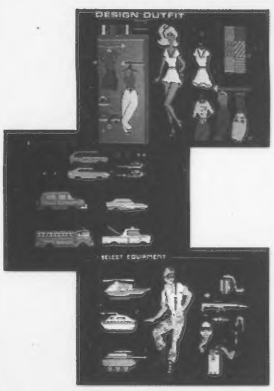

We all know that you can't kid a kid. And younger kids are growing tired of arcade-type computer games that don't hold their interest, while learning programs frequently don't generate any interest at all.

Now, EPYX introduces *Computer Activity Toys,* featuring Barbie,™ Hot Wheels™ and G.I. Joe.® The perfect way for children ages 4–10 to engage in imaginative, non-structured, non-competitive play patterns either individually or with a friend.

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Then draw your

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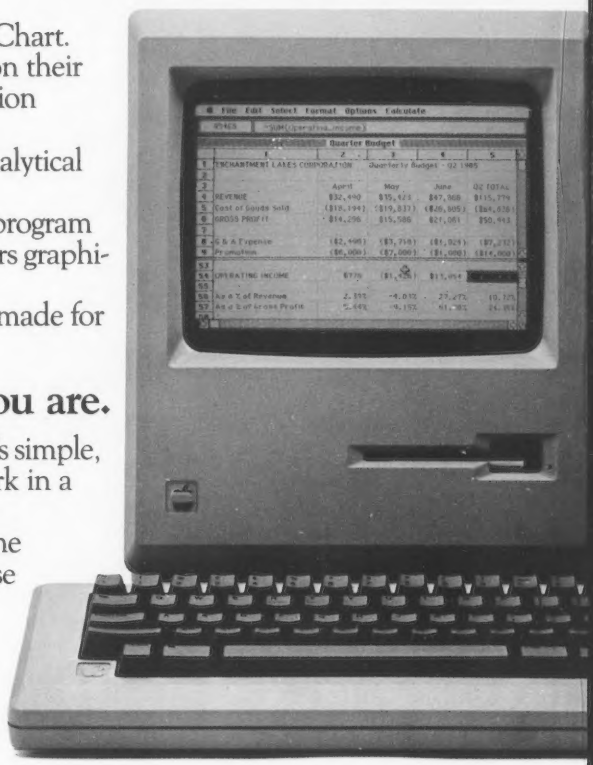
The other, a picture perfect charting program that makes rows and columns of numbers graphically clear.

And the beauty is, they were literally made for each other. And for Macintosh.



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Multiplan takes full advantage of Mac's simple, intuitive operating style. So you can work in a way that will come natural to you.

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Microsoft Chart gives you lots of ammunition for your arguments: Pie charts, bar charts, line, column, area and scatter charts. Or combinations.

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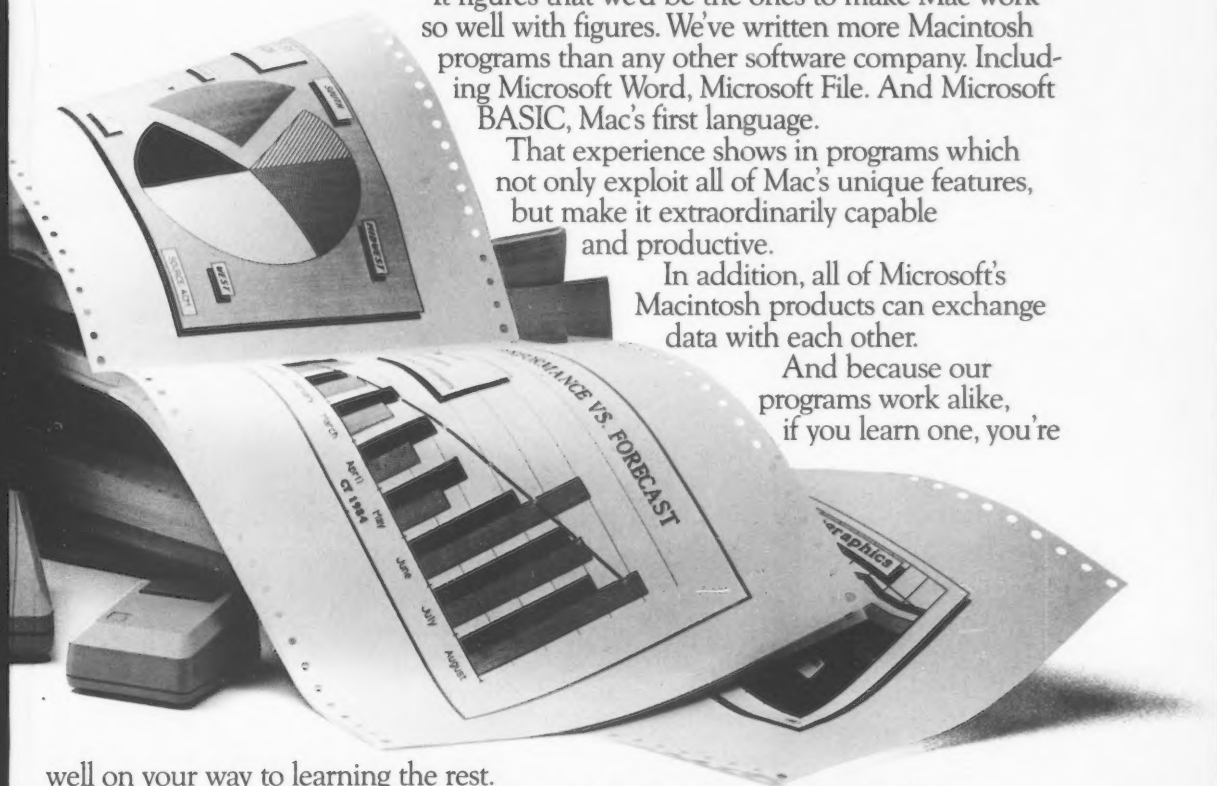

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CIRCLE 136 ON READER SERVICE CARD

Computer Color and the Torture Test

Choosing An RGB Monitor

Russ Lockwood

Using an RGB color monitor with your computer system provides a burst of visual delight only hinted at with a monochrome monitor. It is similar to replacing your black and white television with a color model. Color brings a new vitality to business graphics, reinforces educational lessons, and enhances arcade games.

Of course, not everyone needs an RGB monitor. If your kids only use the Commodore 64 or Atari 800XL to play arcade games, a television will do quite nicely. If you use your computer strictly for word processing and spreadsheet work, a monochrome monitor, which is easier on the eyes than a color monitor, is fine. And for many applications, you can squeak by with a composite color monitor, which provides acceptable color and costs less than an RGB color monitor.

However, if for one reason or another, you are determined to wring the best possible color out of your computer you must choose an RGB monitor.

A Prerequisite

Even the fanciest, most expensive RGB color monitor on the market cannot function without a color graphics board. The monitor plugs into the back of the board, which sends the electronic signals telling the monitor to display the colors and graphics on the screen.

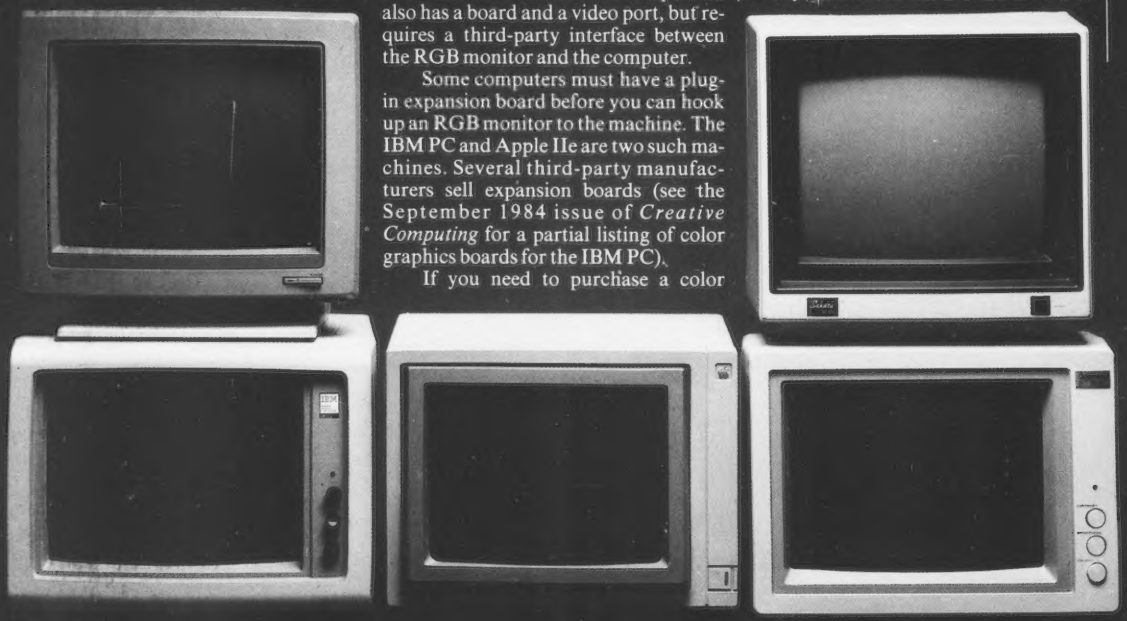
Many manufacturers, especially those that make IBM PC compatibles, include a built-in color graphics board with their machine as part of the overall price. In essence, you just buy the RGB monitor and plug it in—no fuss, no bother, and no hassles. Computers falling into this category include Compaq DeskPro, ADDS PC/I, Tandy 1000, and Panasonic Sr. Partner. The Apple IIc, which is not an IBM PC compatible, also has a board and a video port, but requires a third-party interface between the RGB monitor and the computer.

Some computers must have a plug-in expansion board before you can hook up an RGB monitor to the machine. The IBM PC and Apple IIe are two such machines. Several third-party manufacturers sell expansion boards (see the September 1984 issue of *Creative Computing* for a partial listing of color graphics boards for the IBM PC).

If you need to purchase a color graphics board, be sure it is compatible with your computer. Note that some manufacturers also offer graphics boards that support both color and monochrome monitors, which might be just the thing for switching between graphics and text.

The characters and graphics on your screen actually consist of small illuminated dots, called pixels (short for picture elements). These pixels are created when an electron gun shoots a stream of electrons at a phosphor compound that coats the inside of the monitor screen. The electrons strike the phosphor and create a dot of light.

The electron beam generally starts in the upper left corner of the screen and moves, or scans, from left to right. As the beam moves on, the phosphor begins to lose its luminescence and the display on the screen begins to fade. The beam generally scans the screen at a rate of 30 to 60



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CIRCLE 120 ON READER SERVICE CARD

cycles per second (Hz), which is fast enough to keep the display intact. A display flickers if the phosphors fade too quickly or the scanning is too slow.

In monochrome monitors, the screen has a single color phosphor coating, usually green, amber, or white. A single electron gun shoots electrons at the screen.

An RGB color monitor houses three electron guns, and the screen coating includes red, green, and blue phosphors. One gun turns on red phosphors, one turns on green phosphors, and the third turns on blue phosphors. A shadow mask, a barrier full of tiny holes which lies between the guns and the screen, allows the electrons to hit only the phosphors needed to create a particular color. The video signal from the computer contains a regulator to determine which color lights up and a synchronization signal to keep the particular color lit.

A composite color monitor works more like a TV than an RGB monitor. The video signal mixes the color and synchronization signals together, and the one signal controls all three guns. The signal conforms to National Television System Committee (NTSC) protocols. A composite monitor is not as sharp or bright as an RGB monitor.

The bandwidth, or speed at which the monitor receives the signal, is also important in determining the clarity of the display.

The monitor you buy should have a bandwidth equal to or slightly greater than that of your computer. A monitor with a significantly higher bandwidth than your computer represents overkill—why pay for unused capacity? A lower bandwidth may not use the full capability of the computer.

RGB monitors and color graphics boards have built-in resolution limits, which are measured by the number of pixels displayed on a screen. In general, the higher the pixel resolution, the sharper the image.

This resolution is affected by the distance across the holes in the shadow mask—also known as dot pitch. The smaller the dot pitch, the sharper the image that appears on the screen.

In general, anything with a dot pitch greater than 0.45mm is unacceptable for an RGB monitor because the resolution is just too low. Most RGB monitors fall in the 0.31mm to 0.43mm range. Any dot pitch under 0.31mm should be considered high resolution. Remember, the smaller the dot pitch, the better.

Note that the actual resolution you see on a screen depends on the graphics board, the monitor, and the software. The final output will be no better than the weakest link in the chain.

Terrify a Monitor Today

Prudent shoppers will trek down to their local computer stores and see a monitor in action before buying. After all, seeing is believing—or is it?

The multicolored demonstration displays in stores and in advertisements all look exquisite. They put the best screen forward to show off the capabilities of the monitor. The deep, rich colors of pie charts, graphs, and three-dimensional images dangle in center screen.

At the edges of the screen, however, the quality of the image may deteriorate. Distortion can occur in part because of the curvature of the screen itself and in part because the electron beam does not strike each pixel exactly. Convergence, or misconvergence depending how you look at it, can cause characters on one side of the screen to differ in color from characters on the other side of the screen.

Certain color combinations aggravate the picture circuitry on monitors more than others. For example, when the entire screen is white (all three color guns on) and you create a black line or rectangle at the bottom of the screen (no color guns on), tearing, or stretching, of the rectangle may occur.

Another torture test is to draw a widely spaced grid of horizontal and vertical lines. On many monitors, distortion occurs where the lines meet. Again, black on white is the most severe test.

Listings 1 and 2 (on page 76) are Basic programs for the IBM PC and Apple II series that you can type in and use to torture a prospective monitor. Remember, different machines use different dialects of Basic. Feel free to alter the programs to suit your computer.

You should also consider several other factors before you buy an RGB monitor. Glare, especially in an office setting, can become a problem. Working in color for hours with lights and windows reflected off the screen can cause eyestrain. Many monitors offer specially coated screens to reduce glare. For monitors that do not come with specially treated screens, many third-party manufacturers sell devices to place over the screen to reduce glare.

Size is another consideration. Most RGB monitors come in 12″ and 13″ screen sizes, measured diagonally, although 19″ and 25″ screens are available. For most applications, the 12″ and 13″ sizes are fine. The larger the monitor, the higher the cost.

Most monitors include a set of controls for adjusting the picture on the screen. The placement of these buttons and dials is not consistent—sometimes they appear at the rear of the unit, sometimes on the front to the side, and other times hidden behind a panel or peeking out from the underside of the monitor. Consider the convenience of the location of the knobs that adjust the picture.

Note that every RGB monitor we tested also has internal controls for adjustments by qualified service personnel only.

Finally, a word on quality. RGB monitors, like most monitors, have an excellent record of reliability. Even with heavy day-to-day use, you can count on an RGB monitor to provide many years of service.

We briefly review five RGB monitors in this issue. There are many others on the market. We include a listing of major manufacturers for your convenience. Remember, shop around, keep in mind the criteria detailed above, and try the torture test before you buy. With such a large selection available, it should not be too difficult to find the monitor that is best for your needs.

IBM PC Color Display

The IBM PC Color Display is an excellent RGB monitor for use with the PC. Although RGB monitors with twice the resolution of the Color Display have been introduced by various manufacturers, most applications software is specifically written for the resolution limitations of the PC. Hence, in many cases, higher resolution monitors represent overkill, and the Color Display is quite adequate for most purposes.

The 13″ Color Display plugs into the back of the IBM Color Graphics Adapter expansion board. We have also successfully plugged the monitor into RGB ports of IBM PC compatibles. The graphics resolution is 640 pixels by 200 pixels in high resolution mode (black and white) and 320 pixels by 200 pixels in medium resolution mode (four-color). The dot pitch is 0.43mm. It has a character resolution of 25 lines of 80 characters.

The Color Display measures 11.5″ x 15.2″ x 14.5″ and includes three controls: an on/off button and brightness and contrast dials. A small light by the power switch glows when the

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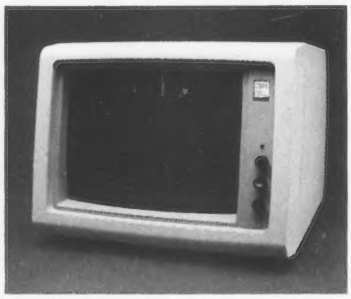
monitor is on.

In our torture tests, the Color Display performed perfectly. It draws a sharply defined grid with no distortion, and the black rectangle is rock solid at the bottom of the screen. All in all, the Color Display passed with flying colors.

Should this surprise you? Absolutely not. Some critics contend those three little letters, I-B-M, stand for premium prices. At $680 for the monitor and $244 for the graphics board, we think the price is competitive. We also agree with those who contend that the letters stand for quality. The Color Display we tested has been used every working day for over two years, and it is still as sharp and bright as ever. The graphics board whines and is on its last legs, but the monitor lives on.

All in all, we can heartily recommend the IBM PC Color Display as an excellent RGB monitor. Sharp resolution, no tearing, and IBM quality make this monitor a good choice for your IBM PC.



IBM PC Color Display.

AppleColor 100

Until recently, only third-party manufacturers offered RGB monitors for Apple II series computers. No longer. After all these years, Apple Computer has entered the RGB monitor market with the AppleColor Monitor 100.

The 12" AppleColor Monitor 100 plugs into the Extended 80-Column Text/Apple Color Card, which fits into the Apple IIe. It can also use third-party RGB expansion boards. A third-party interface is needed to plug the monitor into the back of an Apple IIc. The monitor can also be used with an Apple III or III Plus.

The graphics resolution is 560 pixels by 192 pixels in double hi-res mode and 280 pixels by 192 pixels in hi-res mode. The dot pitch is 0.38mm, and the character resolution is 24 lines of 80 characters.

The monitor measures 11.4" x 14.8" x 14.6" and includes three control buttons and four dials: on/off, power tilt screen, and monochrome emulation buttons; and brightness, contrast, vertical hold, and vertical size dials. The power button is illuminated when the monitor is on.

Instead of adjusting the angle of the screen by hand, you press a button and a motor tilts it for you. Frankly, this seems superfluous to us, but the gadgetry of a power screen may appeal to you.

Putting the monitor in green screen monochrome emulation mode comes in handy for text-only work. With a press of a button, you can switch between color and monochrome display—rather like getting two monitors for the price of one.

AppleColor Monitor 100.

In our torture tests, the AppleColor Monitor 100 performed well. With the exception of a slight curve at the bottom right corner of the screen, the monitor displays no distortion in the grid test and shows no tearing in the inverse rectangle test.

However, we are disappointed with the actual colors. They do not seem to be as bright as they could be. For example, when using *Dazzledraw* from Broderbund, the yellow looks like cream, the red is a dark, brackish shade bordering on brown, and the violet looks more like lavender. Dark blue, light green, and light blue, however, appear quite true.

If you plan to use a lot of double hi-res graphics software, you might be better off buying a composite color monitor. If you intend to use regular hi-res graphics and text, consider the $599 AppleColor Monitor 100. We were quite taken with the ability to combine RGB color and monochrome green in one monitor. The Extended 80-Column Text/AppleColor Card sells for $299.

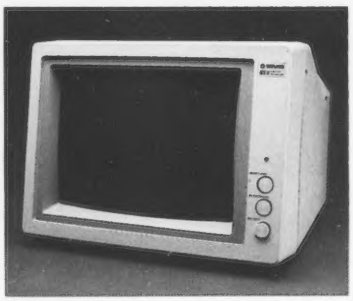
Tatung CM-1322

The Tatung CM-1322 is the first Taiwanese entry into the RGB monitor market. It uses a nine-pin D-shell connector to hook up to an IBM PC or compatible.

The CM-1322 is a 13" RGB color monitor with a graphics resolution of 640 pixels by 400 pixels (interlaced) or 640 pixels by 200 pixels (non-interlaced). The dot pitch is 0.43mm, and the character resolution is 25 lines of 80 characters.

The monitor measures 11.5" x 15.2" x 15.1" and has controls for power, brightness, contrast, vertical hold, and vertical size. A light over the power button shows if the monitor is on.

The torture tests prove that the CM-1322 is an excellent monitor. The grid does not waver on the screen, and the rectangular box remains straight and sharp. Give Tatung credit for producing a quality RGB monitor.



Tatung CM-1322.

The colors are bright and true. We tested a range of software, from a color version of *WordStar* to an arcade game, and all the colors appeared clear and distinct on the screen.

At $679, the CM-1322 is competitively priced. It sports high quality, brilliant colors, and fine resolution.

Sakata SC-200

Sakata Shokai continues in its determined bid to grab a share of the worldwide monitor market. Back in March 1984, we reviewed the Sakata SC-100, an excellent composite color monitor. This time, we review the SC-200, a 13" RGB color monitor.

The SC-200 plugs into an RGB port and provides graphics resolution of 640 pixels by 200 pixels. The dot pitch is 0.39mm, and the character resolution is 25 lines of 80 characters.

The monitor measures 13.5" x 14.3"

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x 16.6" and includes four controls: brightness, vertical hold, and horizontal shift knobs, and an on/off button. We applaud Sakata for using an illuminated power button—you can see at a glance whether the monitor has been left on.

In our torture test, the SC-200 performs magnificently. The grid is whole, with no distortion either where the lines meet or at the edges of the screen. The inverse rectangular box at the bottom of the screen remains sharp.

The colors are sharp and distinctive. We hooked up the SC-200 to a Mindset computer and ran a graphics art package called Lumina. Want to see how the Sakata performed? Take a look at the photos in the Mindset review elsewhere in this issue. The screen shots were taken off the SC-200.

What else can we say about this excellent monitor? Only that at $649, it is competitively priced. If you are in the market for an RGB monitor, give serious consideration to the Sakata SC-200. Superb color, quality picture, and a competitive price make it a formidable contender in the RGB monitor market.

Sakata SC-200.

NEC H-131

The NEC H-131 we tested came with the APCIII (see review in this issue). It sits on a tilt/swivel stand, which comes in handy when trying to reduce glare on the screen or maneuver the monitor so two people can view the screen at once. With a 14" diagonal, the H-131 offers the largest screen area of all the monitors we tested. It also has a graphics resolution of 640 pixels by 400 pixels displaying up to eight colors—twice that of the IBM PC Color Display.

NEC H-131.

NEC notes the dot pitch is 53 dots per inch. After a lengthy conversion process, we figure the dot pitch to be something like 0.37mm, which is smaller (better) than the other monitors. The H-131 displays a character resolution of 25 lines of 80 characters.

The H-131 measures 13.6" x 14.7" x 14.9" and includes two controls: an illuminated on/off button and a brightness knob.

In our torture tests, the H-131 performed well with minimal tearing or stretching in the grid or the rectangular box. We did notice a slight bowing of the left side of the display—nothing major, but perceptible nonetheless. Otherwise, we have only compliments about the brightness of the colors and the clarity of the picture.

Indeed, the monitor displays not only sharp colors, but many colors—eight to be exact. At a resolution of 640 x 400 pixels, that is certainly something to consider if you need many colors and high resolution for business graphics or artwork. Also remember, however, that many software packages do not recognize the superior resolution of the H-131. The final output is no better than the weakest link in the chain.

Overall, the NEC H-131 is an impressive monitor, with double the colors and double the resolution of the IBM PC Color Display. Of course, these extra features are not inexpensive as the $830 pricetag attests. ■

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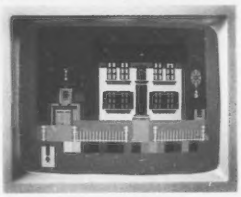

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Monitor Torture Test

Listing 1. IBM PC Version

```
10 CLS: KEY OFF
20 SCREEN 1,0
30 COLOR 15,0
40 FOR I=1 TO 200 STEP 21
50 LINE (1,I)-(319,I)
60 NEXT I
70 FOR I=1 TO 319 STEP 21
80 LINE (I,1)-(I,199)
90 NEXT I
100 FOR Y=1 TO 5000:NEXT Y
120 LOCATE 25,1
130 PRINT "Try this Basic test on your
    own monitor."
140 FOR Y=1 TO 5000:NEXT Y
150 SCREEN 0
160 COLOR 0,7
180 LOCATE 25,1
190 PRINT "Try this Basic test on your
    own monitor."
200 FOR Y=1 TO 5000:NEXT Y
210 KEY ON
220 END
230 'Hold Return key down until screen
    fills
```

Listing 2. Apple Version

```
10 HOME : HGR2 : HCOLOR = 7
11 HPLOT 140,100 : CALL 62454
20 HCOLOR = 0
30 FOR X = 0 TO 279 STEP 21
40 HPLOT X,1 TO X,191
50 NEXT X
60 FOR Y = 0 TO 191 STEP 21
70 HPLOT 1,Y TO 279,Y
80 NEXT Y
90 FOR Z = 1 TO 5000: NEXT Z
100 TEXT : INVERSE : VTAB 24
110 PRINT "TRY THIS BASIC TEST ON YOUR
    OWN MONITOR";
120 FOR Z = 1 TO 5000: NEXT Z
130 FOR X = 1 TO 920
131 INVERSE : PRINT " "; : NEXT
140 VTAB 24 : PRINT " TRY THIS";
150 NORMAL
160 PRINT " BASIC TEST ";
170 INVERSE
180 PRINT "ON YOUR";
190 NORMAL
200 PRINT " OWN MONITOR";
210 FOR Z = 1 TO 5000 : NEXT Z
220 END
```


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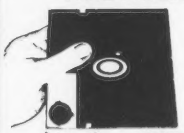

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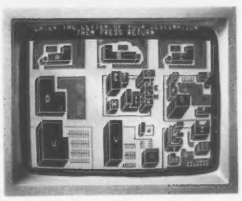

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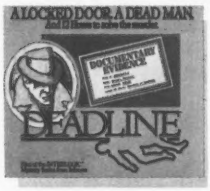
†This isn't *really* a footnote. Just a reminder that MURDER BY THE DOZEN is also available for the Macintosh computer.

ZORK
I

ZORK
II

ZORK
III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The Amplot II is an easy to use capable six-pen flat-bed plotter at a modest price

Amplot II

David H. Ahl

The Amplot II is a six-pen, flat-bed plotter that is quite easy to use. It has 20 drawing commands, reasonably high resolution, and built-in parallel and serial (RS-232) interfaces—all at a very modest price. It even comes with a protective plastic cover.

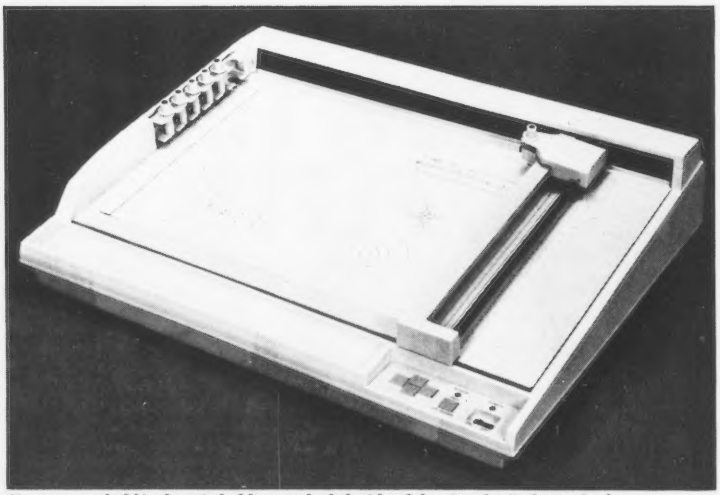
Interfacing the plotter, particularly through the parallel port is extremely simple (although you would never know it from reading the manual). The Amplot II has a Centronics-type connector on the rear; a printer cable from the computer works just fine. The serial interface is only slightly more complicated; it requires a null modem cable (pin 3 to 4, etc.) and can be set to any of five baud rates (300 to 4800), 7 or 8 data bits, and parity, and 1 or 2 stop bits. The important thing is to make sure your computer matches the settings on the plotter.

The Amplot II can handle up to international paper size A3 (11.7" x 16.5") as well as U.S. standard 11" x 17". The effective drawing area is 270 x 400 mm (10.6" x 15.7"). Paper is held down by a paper guide at the bottom of the plotter bed and two 7" magnetic strips at the top.

Six fiber tip pens are furnished with the plotter, one each of red, orange, green, blue, violet, and black. Aqueous fiber tip and oily fiber tip pens (for drawing on acetate) are also available. The pens are loaded by simply dropping them into the six holders at the left of the plotter bed.

Commands are sent to the plotter from Basic, either in an LPRINT statement (parallel interface) or PRINT #1 (serial interface). Commands must be sent as capital letters enclosed in quotation marks, while numeric amounts may be sent as numbers (120, 175) or variables (x, y) not enclosed in quotes.

The plotter surface is divided into 0.1 mm lengths (2700 x 4000), and plotter coordinates are specified in millimeters. The origin may be set any place within the drawing area; for example, if it is in the center, plotting coordinates can range between $\pm$ 1350 and $\pm$ 2000. There are no scaling capabilities.



Six pens are held in drop-in holders at the left side of the Amplot II plotter bed.

Hardware Profile

Name: Amplot II **Number of pens:** 6 **Paper size:** 11" x 17" **Plotting area:** 10.6" x 15.7" **Resolution:** 0.004" **Repetition accuracy:** 0.012"; Different pen: 0.016" **Plotting velocity:** 7.8"/sec **Parallel interface:** Centronics **Serial interface:** RS-232 **Digitizer mode:** No **Dimensions:** 22.8 x 18.2 x 5.5" **Price:** $1092

Manufacturer: Amdek Corp.
2201 Lively Blvd.
Elk Grove Village, IL 60007
(312) 364-1180

Commands include the expected Draw Absolute, Draw Relative (with respect to the last point), Move Absolute, and Move Relative. Line Type specifies solid and three types of dashed lines, while Line Scale sets the repetitive length of line segments; combining both commands allows drawing ten or more distinctive types of lines. Axis draws an x or y axis with hash marks at specified intervals.

The Circle command draws a circle or arc of any radius. Unlike the more general command found on some plotters, this one cannot draw ellipses.

The Home command moves the pen to the lower left position, while Z moves it to the top center. ASCII characters can be printed in any of the four compass directions. "Standard" character sizes range from 3 mm to 11.2 mm high, although it is possible to specify the height and width of a character (up to 200 x 200 mm). Six graphing marks can be drawn in sizes up to 10 mm.

Pen speed can be set to either normal (200 mm/sec) or slow (100 mm/sec). We found the normal speed was satisfactory for all of our tests. The Paper Size command limits the effective drawing area for paper sizes smaller than A3, while the Window command also limits

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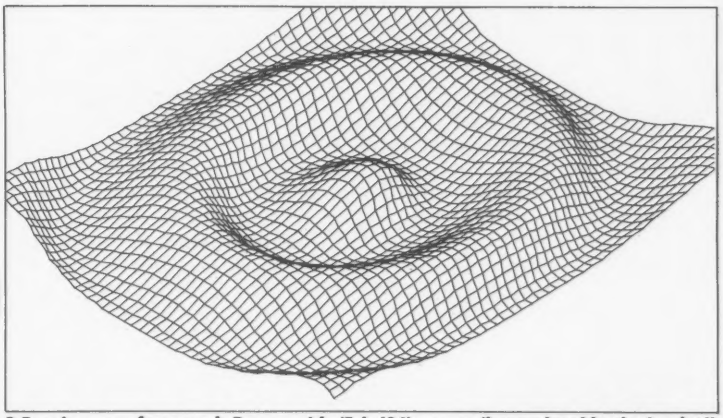
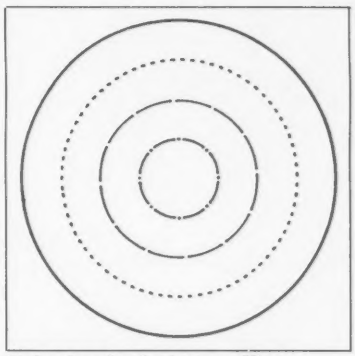


3-D cosine wave from van de Panne article (Feb. '84) was easily translated for the Amplot II.

Letters can be printed in four directions.



Circles show four basic types of lines.

the effective drawing area, temporarily, for drawing several charts on one piece of paper.

Making Plots

We found it quite easy to take programs written for other plotters and adapt them to the Amplot II. In general, only a few minor changes were necessary in plotter commands and variable values. During conversion, this led to some errors when values were out of range or when incorrect commands were sent to the plotter. When the plotter receives an erroneous command or value, it halts and a red LED comes on. The error can be cancelled by pressing any one of the four pen direction switches; this clears the data buffer and readies the plotter to accept more commands. (Actually, when debugging a plotter program, we find it best to do so without a pen in the holder. When things "look" right, it can be run with a pen.)

As mentioned earlier, the step size is 0.1 mm; the manufacturer-specified repetition accuracy is 0.3 mm with the same pen or 0.4 mm with different pens. In practice, we found the accuracy to be better than that.

The manual contains two sample programs for drawing a bar chart and a combined bar and pie chart. We weren't enthralled with the efficiency of coding, but the programs are well-explained and demonstrate most of the plotter features. Notes at the end of the manual offer helpful tips on how to use the plotter with an IBM PC and overcome the Device Timeout problem. Users of other computers will find these tips helpful as well.

All in all, we were impressed with the Amplot II. It is easy to use, has both serial and parallel interfaces, and has good resolution and accuracy. While it is not in the same league as the Houston Instruments DMP-29 (which costs more than twice as much), it is an able competitor in the $1000 multi-pen plotter derby. ■

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A compact internal modem for IBM PCs and compatibles

Ven-Tel Modem

Russ Lockwood

A modem, once an almost esoteric optional peripheral, has become almost a necessity in the business world today. Executives and professionals are finding that they can transmit and receive information faster over the telephone lines than by overnight mail. Coupling this speed with a transportable computer in the field lets them communicate information in an even more timely manner. And businessmen know that time is money.

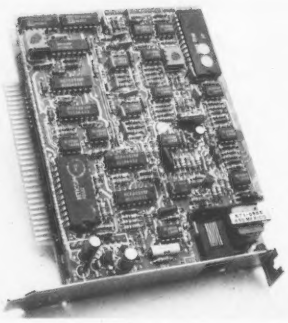
Ven-Tel manufactures the PC-Modem Half/Card, a 300/1200 baud, direct-connect internal modem for the IBM PC and compatibles. It is half the length of a standard expansion board, so it fits in the short slot of the IBM PC XT and in transportable computers like the IBM Portable PC and Panasonic Senior Partner.

The modem looks like a full-length board folded in half. Actually, the Half/Card is two half-sized boards on a single mounting and is slightly thicker than a single board card. The modem is well constructed, with secure connections and the more fragile components sufficiently protected. No patches, jumpers, or other jury-rigged connections appear on the boards. Obviously, Ven-Tel maintains high production standards.

Installation

Installing the Half/Card is a snap. Just follow the excellent documentation. In short, you need only remove the system unit and expansion slot covers, gently press the modem into an expansion slot, secure the modem to the system unit with a screw, and reattach the system unit cover.

The last step is to plug the phone cord (included with the Half/Card) into the modular phone jacks on the wall and on the back of the modem. The modem draws power directly from the computer.



Hardware Profile

Product: PCModem HalfCard **Type:** 300/1200 baud internal modem **System:** IBM PC and compatibles **Format:** Half-sized plug-in board **Software:** Crosstalk XVI communications package **Documentation:** Looseleaf manual **Price:** $549 **Summary:** Excellent internal modem for short or regular expansion slots.

Manufacturer: Ven-Tel
2342 Walsh Ave.
Santa Clara, CA 95051
(408) 727-5721

Bundled Software

Ven-Tel includes *Crosstalk XVI*, a powerful command-oriented communications program from Microstuf, with the Half/Card. The program provides two methods of sending a file. The XM command uses the *Crosstalk* protocol, while the XX command uses the popular Xmodem protocol.

The program also features automatic log-on command files, programmable function keys, viewing transmission time and file size for each file, error checking of the file transfers between systems using *Crosstalk*, terminal emulation, and sending files to disk or printer.

Performance

Testing a modem is quite straightforward. A modem translates outgoing digital code into analog signals and deciphers incoming analog signals into digital code. Thus, it either transmits and receives data or it does not.

We believe a modem should be a completely transparent device, that is, once it is hooked up to your system, you should never have to worry about it again. This is doubly true for internal modems. After all, out of sight, out of mind.

The Half/Card performed flawlessly at both the 300 and 1200 baud speeds. Local or long distance, bulletin boards or sending files—the modem worked perfectly first time, every time.

Our Communication

Our evaluation unit did not contain a built-in speaker. The software monitors the status of your communication. However, Ven-Tel has released a new version of the Half/Card that includes an on-board speaker and an extra phone jack. Other than these minor upgrades, the new modem is functionally identical to the one we reviewed.

As we have mentioned, the manual is well written, profusely illustrated, and complete. It divides into two sections: modem installation and software operation.

The *Crosstalk* section starts you out with simple communications. The more proficient you become, the further into the manual you can delve to use all the features of the program and modem.

If you are looking to buy a full featured, 300/1200 baud internal modem for your IBM PC, consider the Ven-Tel Half/Card. If you need a half-sized modem for your IBM PC XT or transportable computer, put the Half/Card at the top of your list. ■

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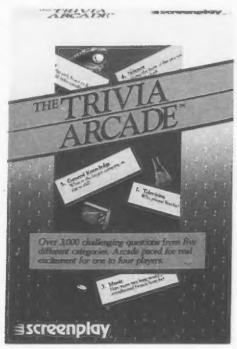
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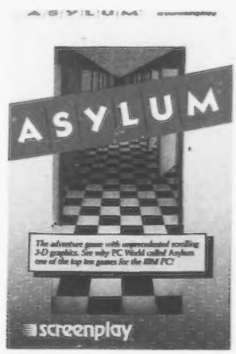

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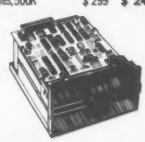

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A full-blown big brother for 1-2-3

Lotus Symphony

Thomas Badgett

A software "sequel," such as *Symphony* from Lotus Development Corporation, producer of *1-2-3*, begs comparison. So much of the personality of *1-2-3* is evident in *Symphony* that it is impossible to ignore the similarities. The differences, too, are notable.

Symphony is an "integrated" package that includes a spreadsheet, word processor, data manager, graphics generator, and communications services. It is marketed for the IBM PC and Compaq, though it will run on many PC compatible machines, and there is a plethora of custom versions. *Symphony* runs well, though at somewhat reduced speed, on the IBM PCjr with additional memory.

Before you purchase *Symphony*, check with Lotus or your dealer to make sure it will run satisfactorily on your machine. The function key template that comes with the package won't fit the Compaq keyboard, but Lotus will supply one that will, when they receive your registration card.

Like its predecessor, *Symphony* is loaded once into memory. Then, unless you need to print graphs or use some of the other arcane functions, no further program loading is necessary. The difference is that *1-2-3* requires about 128K of system RAM for program instructions while *Symphony* uses twice as much. Lotus recommends a minimum of 320K of memory to use *Symphony*, but a more practical configuration would include 512K. With the minimum RAM you can load the program and use all of the software features, but the amount of data you can manipulate is reduced.

Indeed, with any system, this is a hungry package. A 512K PC AT or Compaq will allow you to fill about 13 thousand cells (more than 116,000 characters). This is a lot of space. You could write a document of about 45 single-spaced pages or construct a typical name and address file with around 1000 records. Still, this falls far short of what Lotus advertises for *Symphony*: 2,097,152 cells or about 18.8 million characters. In theory the software provides a workspace of 8192 rows by 256 columns. The reality—given present hardware limitations—is much less. Careful memory management and space allocation are necessary with this package.

Overview

Lotus calls each major program function an "environment," a way of handling the information stored in any *Symphony* file in different ways. To change environments, press the TYPE key (alt/F10) and select one from the environment menu. While different environments display information in slightly different ways, *Symphony* is always basically a spreadsheet. The Row/Column structure is there, to one degree or another, regardless of which environment you are using.

Symphony supports virtually unlimited windows. The word processor has a few cumbersome features, but it is all the word processor many people will ever need. There are data communications upload/download/capture capabilities. The graph and spreadsheet functions have been expanded over *1-2-3*. Data management is really possible to use, and the macro programming language is greatly enhanced.

The *Symphony* menu tree is extensive. This software is more powerful than *1-2-3* and therefore has more commands. To help, *Symphony* uses function keys extensively. The F9, or SERVICES, key displays choices such as Print, Window, and File in all environments. The F10, or menu, key displays different choices with each environment. You can still access the Sheet menu with the slash, but in other environments you must use F10.

Lotus designed *Symphony* for access by other programmers. Hooks inside the software help developers write applications for the *Symphony* environment. Add-in applications directly from Lotus also are expected. Obviously, Lotus wants *Symphony* to be your only program. Whether this idea is valid depends on several factors, not the least of which is how well the package works with the expanded RAM of such computers as the IBM PC AT. With up to three megabytes possible, *Symphony* memory problems could become a thing of the past.

Applications

Symphony is a relatively new package, but already users are designing predictable as well as unusual applications around it: stock quotations and proposals, earthquake studies, technical models, budgets and company financials, word processing, data communications—*Symphony* does them all, with varying levels of success.

Software Profile

Name: Symphony **Type:** Integrated package (five functions) **System:** 320K IBM PC or Compaq; dual double sided, double density disk drives. **Format:** Disk **Summary:** A complete business package with spreadsheet, graphics, word processing, communications, and data filer. **Price:** $695 ($200 for *1-2-3* upgrade)
Manufacturer: Lotus Development Corporation
161 First St.
Cambridge, MA 02142
(800) 248-8002
(617) 492-7171

A New York financial consulting firm, Kidder, Peabody and Company, Inc., is sold on the *Symphony* package. They have set up 15 IBM PCs in a local area network, with each workstation running *Symphony*. The system is used primarily to prepare client proposals based on information downloaded from the Dow Jones network and other data providers. Financial data are organized with the *Symphony* Sheet environment to produce statistical information and projections. Supporting documentation and recommendations are written in the Doc environment.

Kidder's specialist Wayne Blackstone estimates the *Symphony* arrangement is saving each user two hours daily. "We're still learning about the system," Blackstone observes, "but so far we haven't encountered any major problems."

"It's a great program, but still something of a letdown," observes Eugene Cundiff, data processing manager for Flat Top Insurance, a major West Virginia-based insurance broker. "The spreadsheet is fantastic and all of the improvements over *1-2-3* are everything I expected, but the database and word processing environments aren't as powerful as I had hoped they would be."

But *Symphony* is still one of the best choices for his company's micro software, because by training personnel on one package, he has given them many applications. He'll probably add more *Symphony* workstations in the near future, primarily for budget analysis and financial reporting.

Ted Habermann is using *Symphony* "fairly heavily" for earthquake prediction research in California. He was already using *1-2-3* when *Symphony* was released, so the transition to the new software was a logical step.

New York's Learning Annex, an adult continuing education organization, uses *Symphony* to track data for Securities and Exchange Commission reports dealing with the firm's recent public stock offering.

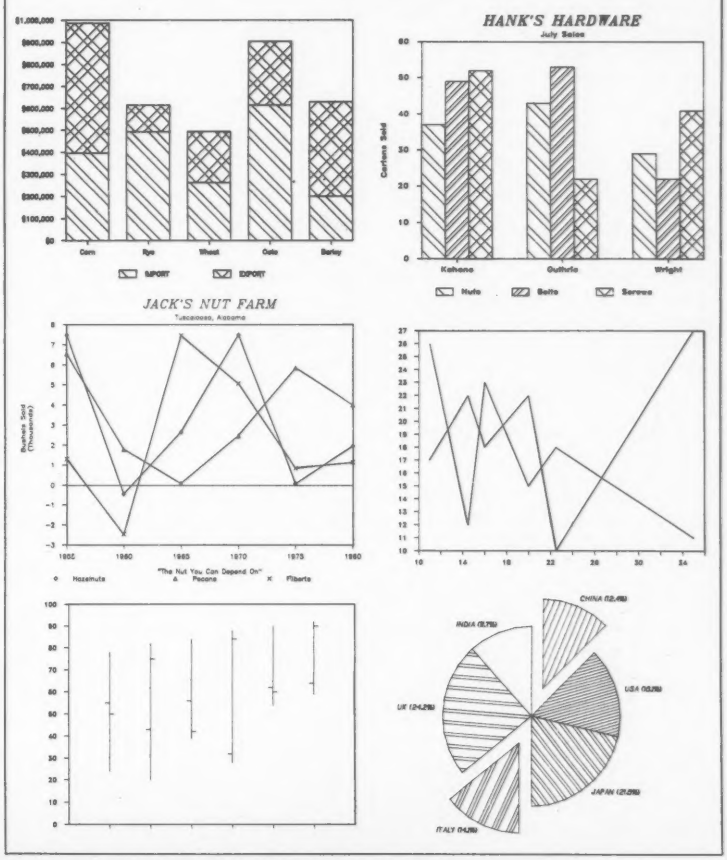
AT&T Information System offices in New Jersey use it for technical modeling and database functions.

Hans Michna, a German computer consultant, has a number of clients who use the word processing and other functions of *Symphony* with success.

All of these users report some problems with the program and they wish for improvements or new features, but generally they are pleased with *Symphony*.

- Communication and enhanced word processing
- Expanded menu tree
- Improved database handling
- Expanded program (macro) language
- Macro Learn command for self-programming
- Range name table to show cells in each range
- Windows
- List command to view entire disk directory
- Program hooks to support outside applications
- Will load *1-2-3* files and print *1-2-3* graphs

Symphony Enhancements Over 1-2-3.



Symphony can produce six types of graphs in seven colors.

The ability of *Symphony* to create windows for different applications is a versatile and useful addition. Custom window structures make parts of a worksheet appear in different windows. Each window can hold a different environment, so you can move from a document, to a spreadsheet, to a database, all within the same workspace, simply by changing windows.

Each window may be sized to fill the screen, or occupy only a small portion of it. You can view several parts of the worksheet at once, in effect running multiple applications simultaneously. The obvious limitations are screen size and memory size.

"In theory you can have as many windows as you want—dozens of them," says AT&T Information Systems consultant Ben Moskovits. "But as a practical matter, it's crazy once you go beyond two screens. There is just so much room on the screen. The difficulty of manipulating so many different screens makes any more impractical."

But a two-way split, so you can look at a spreadsheet, say, in one window and write about it in another, works well. A special pane option lets you quickly divide the screen into four quadrants to look at related parts of a worksheet, but the visible space for each pane is so small it probably isn't practical to do much work in this configuration. You can name each window and call it from a window menu. But regardless of how many windows you create, you still can see only portions of one worksheet. *Symphony* can't load more than one application into memory at a time.

Macros

One of the strongest, though least used, features of *1-2-3* is its macro capability. This command language lets a skilled user preprogram a virtually unlimited sequence of keystrokes and assign the group of commands a macro name. Then with just two keystrokes you can invoke the entire sequence. But this macro language is difficult to learn and, once learned, isn't easy to implement. If you don't use it, however, you are limiting the usefulness of the software.

With *Symphony* there is a "learn" mode which, in effect, tells the software to program itself. You enter the keystrokes you want for the macro, and the software writes the program steps. The *Symphony* command language is expanded, so the potential for sophisticated macro programming is impressive.

The Sheet Environment

The Sheet environment is very like that of *1-2-3*, with some enhancements. The range functions and menu features are expanded, for example, but the *Symphony* spreadsheet remains compatible with *1-2-3*. You'll find, however, that numerical data entered in the Sheet environment can't be edited in the word processor. Also labels (text) not left justified (anything with leading spaces, such as cells entered with " or ^ formatting symbols) can't be edited in the Doc environment.

While *1-2-3* uses file extensions of .WKS, *Symphony* uses .WRK, so you may want to rename all *1-2-3* files before using them with *Symphony*. Macros designed for *1-2-3* may not work without modifications because of different menu structures and some command differences. A Save macro in *1-2-3*, for example, might look something like: \ fs ~ r. In *Symphony*, it is {SERVICES}fs ~ y.

"We had people running around all over the place, no direction, no integration, before Symphony."—Wayne Blackstone, Applications specialist, Kidder, Peabody and Company, Inc., New York.

The Doc Environment

The Doc or word processing environment works much like any full-screen editor. But if you switch to the Sheet environment, you'll find that each line of text actually is a long data label with its origin in the left-most cells of each row. While you are using the Doc environment, however, this data arrangement is transparent.

Many of the commands—move, delete, copy, etc.—are accessed with the Menu key just as you do in the other environments. You can display two or more windows simultaneously, or switch between windows with one keystroke to make writing documentation about spreadsheet or graphics information a breeze. You can print with underline, bold face, and justification, and perform other word processing functions, but these special text attributes don't show on the screen.

If you are looking for a highly sophisticated word processor with footnoting, index preparation, proportional spacing, and other specialty features, this isn't it. For average word processing chores, however, including merging a letter with a database, *Symphony* will do very nicely.

If you are used to dedicated word processing software, you will probably find *Symphony* a little slow. The speed differences aren't too noticeable on a PC AT, but with the PC and Compaq machines, the screen update is noticeably slower than with other software. You won't lose any information, but characters don't always appear on the screen just as they are typed. Sometimes there is a delay of a word or more, and suddenly the program catches up, only to fall behind again.

After you move or delete a block of information, the paragraph is automatically reformed. But if you use the backspace key to remove several words, you must reformat the text manually from the Menu. This process seems a little slower than most word processors, and there is an occasional anomaly, connected, perhaps, to the roots of the Doc environment in the *Symphony* spreadsheet. If you format a paragraph, then press TAB to indent the first line, everything after the first couple of words will break off to the next line, leaving a chopped up paragraph that must be reformed from the Menu again.

Page breaks aren't obvious in the Doc environment. You can use the WHERE? function, which will tell you which page and line the cursor is on, but you can't scroll through the text to find out if the printed document will fall on logical page boundaries.

You can load text from just about any word processor, but be prepared for some heavy editing. ASCII text files loaded from DOS include hard carriage returns at the end of every line, and with *Symphony* there is no way to edit them. There may be a way to get the software to print a double-spaced text from a "foreign" ASCII document, but it isn't obvious from the documentation. Text entered into *Symphony* from the keyboard can be printed in single-, double-, or triple-space, but only single-spacing appears on the screen.

The Form Environment

The Form environment is another way of looking at the data entered on the

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spreadsheet. Form manipulates "database" type information: mailing lists, product or inventory information, sales statistics. All information in *Symphony* is stored in spreadsheet cells, but by specifying different environments you can view the data in different ways. A sales statistics file, for example, might have field labels such as Sales Person Name, Current Sales, YTD Sales, High Month, Low Month, Average, Office, Telephone.

To set up a Form environment, first enter these field labels in separate cells horizontally across the top of the spreadsheet or across the top of a spreadsheet range. Then select the Form environment from the Type menu and "generate" from the Form menu. *Symphony* then creates the database, complete with a data entry form, a "criteria" record used in searches, and other information. The range of this data sheet expands as you enter new records; or, you can change the range manually to reserve space for your database.

Now, as you work with the data records—enter, search, sort, edit, or print—you use an input form designed by *Symphony* instead of the horizontal spreadsheet memory cells. Each complete record can be displayed on the screen—if it isn't too large to fit. If you need to look at more than one record at a time, you can view the database from the Sheet environment in the usual way.

The Comm Environment

The communications environment supports only two modems, the Hayes SmartModem and the Popcom. You can capture online information to the worksheet or disk, and originate or answer calls. A fairly wide range of communications settings is possible. You can set many of the operating characteristics of your favorite terminal into a Comm window. By presetting a telephone number, log-on sequence, and terminal settings in separate windows, you can automate the initial calling procedure. You can't switch modem types from within the worksheet, however. And you may find that some "Hayes compatible" modems won't work properly with *Symphony*.

The Graph Environment

The graph features of *Symphony* are the same as those of *1-2-3* with the addition of a special High-Low-Close graph for stock data. The *Symphony* printgraph program will print *1-2-3* graphs. You can use the Doc environment to add text to a graph, but you won't be able to print this composite graph. Only Graph environment labels will print with Printgraph.

Problems

Symphony is a powerful software package, but it is not without problems. Some users have complained about the large number of commands, but Lotus has made the *Symphony* learning curve relatively steep. They have kept the spreadsheet portion of *Symphony* compatible with *1-2-3*, for one thing. Anyone with *1-2-3* experience can do useful work with *Symphony* almost immediately. *Symphony* has some expanded features, but the old, familiar *1-2-3* sheet commands are right there.

"You must not reset my printer. Please don't reset my printer."—Hans G. Michna, computer consultant, Germany.

Even if you aren't familiar with *1-2-3*, learning *Symphony* really isn't too difficult. If you can remember that F9 is the SERVICES key and that F10 invokes a menu tree, you can get along reasonably well. Moreover, most users are strong on one or two features but probably don't use the rest of the software to full capacity, so the learning task is further diluted.

Symphony is quite cavalier in its treatment of the host. It stumps into your computer, blindly initializing keyboard and display settings. If you normally use routines to preset screen attributes, or a keyboard programmer such as *ProKey*, you will be disappointed to learn that *Symphony* won't have any of that. The display comes up in different ways, depending on how you have installed the software, but you have no control over it while *Symphony* is running. *Prokey, Sidekick*, and other memory resident routines probably will be wiped clean when *Symphony* loads.

Some users report problems with the printer handling of *Symphony*. During installation you may specify one of 31 printers, but you can't select different printers from within the program. The only way to use different printers is to exit and reload a version that was installed for the new printer. Since many users who need the integrated functions of a package like *Symphony* have one high speed printer for draft and data, and a high quality printer for word processing applications, this inconvenience seems to evidence a lack of practical planning by *Symphony* designers.

A less common but potentially more serious and frustrating problem is that *Symphony* resets the active printer as if it were a reboot from DOS. There are some sensible arguments for doing this, but the user who configures his printer for special features from a .BAT file before loading *Symphony* won't like it.

"If you want to think for the user, do it right or don't do it," writes Hans G. Michna in a lengthy and spirited letter to Lotus about the printer problem. Michna also believes the program could be more generally useful if Lotus would tie the print layout to the active window, rather than the window in which it was designed. He also believes the Doc environment should be enhanced. But overall he likes the program and calls it, "a revolutionary and far more efficient approach to programming and problem solving with computers," than earlier methods.

You can still load a new worksheet on top of an unsaved sheet, just as in *1-2-3*. The key is to develop a simple Save macro that makes it easy to store your current work frequently.

Conclusion

Symphony may not be for everybody. Even though registered *1-2-3* users can upgrade to the new software for $200, think carefully about your needs and goals before you spend even this much. *Symphony* is memory hungry. Because it requires, practically, a 512K computer system, you may have to add more hardware to your system just to make the new software run. If you are getting along well with *1-2-3* and don't actively need the added features of *Symphony*, it doesn't make sense to upgrade. If you are pushing *1-2-3*, and your patience, to the limit, the change may be a good move.

You will probably like *Symphony*. It is noticeably more powerful than *1-2-3* but not too difficult to learn. You may experience a certain amount of frustration at times—especially if you are used to comprehensive, dedicated packages for some or all of the *Symphony* environments, but with a little adjustment, it may be all the software many users ever need. ■

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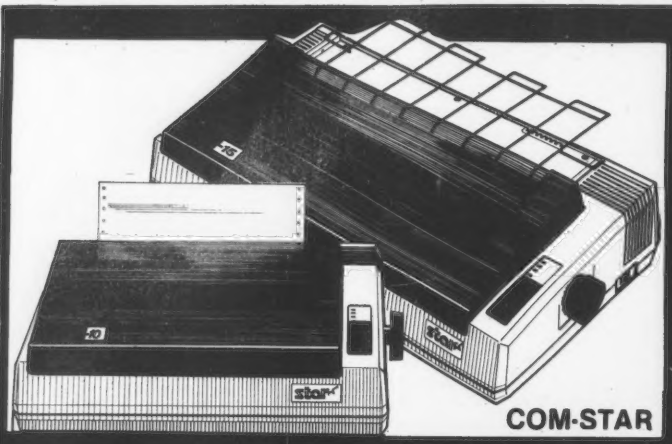

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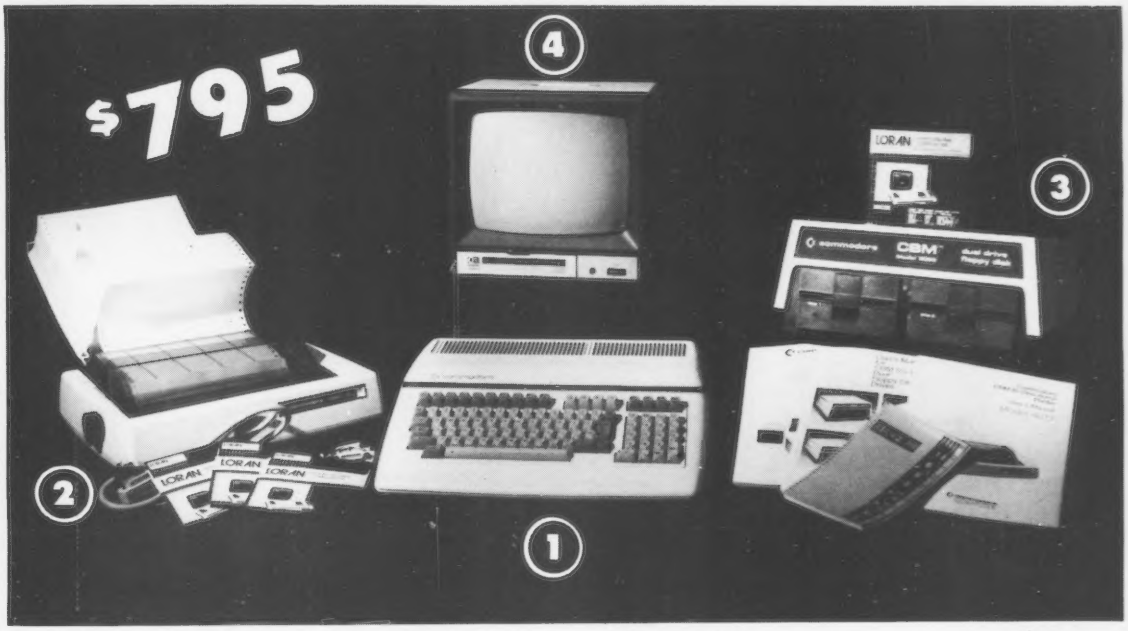

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DR Draw and DR Graph

Kerry Leichtman

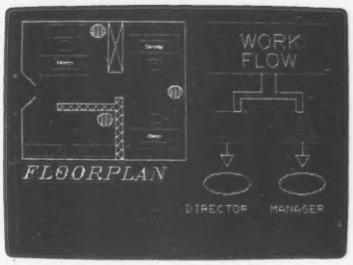
Ease of use, speed of execution, and quality of result—these are the criteria we use in judging graphics packages. *DR Draw* from Digital Research scores well on the first and last, but earns only two or three points (on a scale of 1 to 10) for speed. *DR Graph* also scores well on ease of use and quality of result. *Graph*, however, falls into the minus column when it comes to speed.

These sister programs are not alone in this shortcoming. Commercial programmers have been busy perfecting programs to crunch words and numbers. Few have applied themselves to the task of creating programs to make pictures. And who can blame them? Writing a good graphics application program is not an easy chore. The output of a graphics program must look clean and crisp on a color or monochrome screen, a dot matrix printer, a plotter, or an inkjet printer. Shapes, sizes, colors, patterns, character fonts, and geometric formulae combine in myriad ways—too many ways to be stored in RAM, which leads to frequent disk access during program use, which, in turn, makes such programs slow.

DR Draw and *DR Graph* are slow. That said and the fact that most, if not all, of their competitiors suffer from the same limitation duly noted, let's get on with the good stuff.

DR Draw

DR Draw works like an on-screen drawing board. The opening screen is blank except for the choices Create, Recall, Edit, Save, Directory, Output, and Exit stretched across the top. You make your selection by placing the cursor over the function you want. If you choose Create, a new set of choices appears: Add, Change, Select, Move, Copy, Undelete, and Delete. The rest of the screen is occupied by a dot-grid drawing board. Choosing Add calls the third menu:



Software Profile

Name: DR Draw and DR Graph
Type: Busines graphics **System:** CP/M, MS-DOS **Format:** Disk **Summary:** Good end results, easy to use, slow in execution
Price: Draw $295, Graph $195
Manufacturer: Digital Research, Inc.
P.O. Box 579
Pacific Grove, CA 93950
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Text, Polygon, Circle, Arc, Lines, Markers, and Bar.

To create a picture, you position the cursor, which appears as crosshairs, on the drawing board after you have made the appropriate series of menu selections. *Draw* offers a sizable choice of fills and colors (for computers with color capability only, of course). The program supports a variety of text fonts and comes with a disk of 12 additional fonts. Also included in the package are two disks of additional device drivers which allow *Draw* to work with a variety of hardware configurations.

I enjoyed using *DR Draw*. The menus are so good that they make the manual almost unnecessary. Doodling is especially easy and produces some surprisingly nice results.

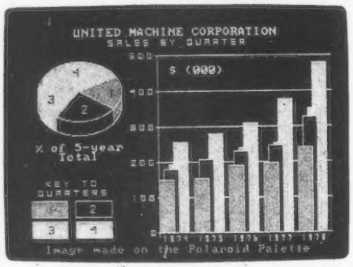
My only real complaint about the program is that it is unforgiving when you make the wrong selection and find yourself in the Creation Menu. Such a specific mistake is worth mentioning only because I did it often enough for it to become a problem. To get back to the picture on which I was working, I had to Recall the picture and wait for the program to go through the tedious process of redrawing the entire screen—disk I/O and all. Even though I had not cancelled the work or started another picture, the computer did not retain my screen in RAM so it could be recalled instantly. What all this does is exacerbate the speed problem and exasperate the user.

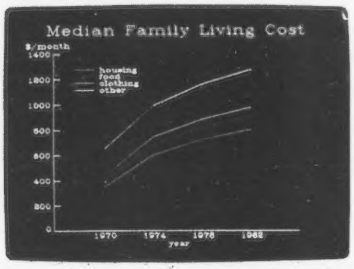
DR Graph

Creating a graph with *DR Graph* is more complex then creating a picture with *DR Draw*. To create a graph the computer must convert supplied numbers and statistics into pictures or graphic representations. This requires a multitude of operations—the very things that computers do best. The more functions the computer is called upon to perform, however, the longer it takes to execute the task.

To build a relatively simple bar graph, for example, the computer first takes numerical data and establishes relational values. Next, it decides what scale to use to make the graph fit within the parameters you have specified—not to mention the paper or screen upon which it is to be displayed. Then it determines the size of the bars in relation to one another and places them on the screen. Next, it generates the characters for the labels, and so on. You can see why *DR Graph* is slow.

But it does produce good graphics. Its lack of speed discourages experimentation rather than use. To be happy with *DR Graph*, you must have a reasonably clear idea of what you want as a result almost before you begin the graphing process. And you will be happy with the result. It is important to keep your





goal in mind, because until super fast graphics programs become commonplace, we will have to judge them by the results they offer rather than by the length of time it takes to achieve those results.

Graph uses menus in much the same manner that *Draw* does. But whereas *Draw* is almost totally menu-oriented, *Graph* requires you to enter numerical statements and relational data. It is this entry of data that makes the documentation a welcome resource long after you have mastered the mechanics of program operation. The manual adequately defines terms and parameters and offers good examples of the causes and effects of most functions. The structure of the menus is consistent, so it is easy to flow from one function to another.

DR Graph allows you to create line, clustered bar, stacked bar, step, stick, scatter, and combination graphs. Data can be entered via the keyboard or called from *SuperCalc* or *VisiCalc* files or from another graph.

You can control the size of both text and illustrations on your page. Four fonts are available—the resident device font, Simplex Roman, Duplex Roman, and Complex Italian. Other variables you can control include color, line thickness, and graph and page borders. Skillful use of these options results in high quality graphs suitable for the most exacting business and professional presentations.

Included with the *DR Graph* package are 128K and 192K versions of the software as well as a 192K version for systems with an 8087 coprocessor. Two disks of driver programs are also included. The documentation, like that of *DR Draw*, is excellent with a good glossary, detailed index, clear writing, and plenty of screen illustrations.

Summary

Except for a few quirks, both programs run smoothly and produce fine results. The font and drive libraries make it relatively safe to assume compatibility with many hardware configurations.

If you are shopping for a business graphics program, be sure to include *DR Graph* and *DR Draw* on your list. Although lack of speed is not a problem to be taken lightly—neither are the benefits of ease of use and quality of result. Both programs are exceptionally easy to use and both produce excellent results. ■

CIRCLE **422** ON READER SERVICE CARD

GEM: A Compatible Standard?

The Graphics Environment Manager (GEM) from Digital Research is a software package that provides a structure for manipulating graphics images such as icons, pull-down menus, and windows. It is aimed principally at OEMs, Value Added Resellers, corporate programmers, and others who are developing graphics applications programs for the IBM PC and compatible machines.

The GEM Programmer's Toolkit includes object code for a virtual device interface (supports graphics call portability across physical hardware such as graphics screens and I/O devices), screen and peripheral drivers, fonts, utilities, and much more, including documentation and access to Digital Research people over a toll free line.

Since *DR Graph* and *DR Draw* were created using elements of GEM, we expect future packages created by other vendors with the use of GEM to be largely compatible with these two DR releases. Furthermore, since the GEM VDI is based on the emerging graphics standard of ANSI (American National Standards Institute), this product could be an important step toward graphics compatibility on microcomputers.—*DHA*

". . .I finally figured out your problem Renfern, . . .you're short on pixels."

What made over 100,000 Apple II owners fall in love with System Saver?

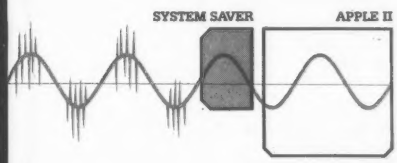
It's the most versatile, most convenient, most useful peripheral ever made for the Apple.

System Saver filters out damaging AC line noise and power surges.

70-90% of all microcomputer malfunctions can be traced to power line problems.* Problems your System Saver guards against.

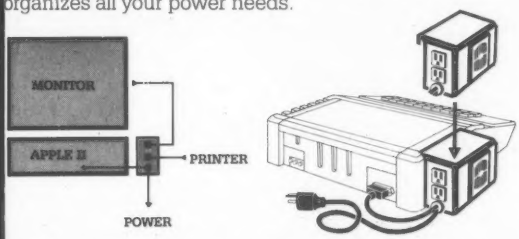
Power line noise can often be interpreted as data. This confuses your computer and produces system errors. Power surges and spikes can cause severe damage to your Apple's delicate circuitry and lead to costly servicing.

System Saver clips surges and spikes at a 130 Volts RMS/175 Volts dc level. A PI type filter attenuates common and transverse mode noise by a minimum of 30 dB from 600 kHz to 20 mHz with a maximum attenuation of 50 dB. You end up with an Apple that's more accurate, more efficient and more reliable.



System Saver makes your Apple more convenient to use.

No more reaching around to the back of your Apple to turn it on. No more fumbling for outlets and cords to plug in your monitor and printer. System Saver organizes all your power needs.

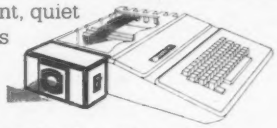


It functions as a multi-outlet power strip with two switched outlets. Plus System Saver offers the ultimate convenience; a front mounted power switch for fingertip control of your entire system.

System Saver lets your Apple keep its cool.

Today's advanced peripheral cards generate heat. In addition, the cards block any natural air flow through the Apple IIe creating high temperature conditions that shorten the life of the Apple and peripheral cards.

System Saver's efficient, quiet fan draws fresh air across the mother board, over the power supply and out the side ventilation slots. It leaves your Apple cool, calm and running at top speed.



So if you want to keep damaging heat, line noise and power surges out of your system for good, pick up the only peripheral that's in use every second your computer is in use. The System Saver. You'll soon come to think of it as the piece Apple forgot.

Compatible with Apple stand

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KENSINGTON™ MICROWARE

*PC Magazine: March 1983

System Saver is UL Listed. System Saver's surge suppression circuitry conforms to IEEE specification 507 1980, Category A. Available in 220/240 Volts, 50/60 Hz.

System Saver is a registered trademark of Kensington Microware Ltd.
© 1984 Kensington Microware Ltd. System Saver is patent pending.

CIRCLE 134 ON READER SERVICE CARD

Illustration by Joel Naprstek

Choosing and Using

Telecommunications Software

Barry Keating

Telecommunications: The Ideal and the Reality

To end missed messages, telephone tag, lost correspondence, and serious business delays—to share instantly new and vital information with everyone involved in a project—to contact 200 people in the time it takes to contact one—these are just a few of the promises of the ideal world of microcomputer-based telecommunications . . .

Vincent arrived at the office early this Monday because he had come straight from home rather than stopping for his usual cup of coffee and conversation in the lobby Coffee-Corner. He was troubled by the way the market had closed on the previous Friday and felt he should notify the other trust officers of the reasons he was switching from Treasury securities to long-term corporate bonds.

Sitting at his desk, he called up his word processor and jotted the note he had composed during the drive in. When he had finished typing, he dispatched the note to the trust officers by typing "trust officers" in the "Mail to:" position on his mail form. The note would soon be in the "mailbox" of trust officers located from New York City to San Francisco—his mail program would take care of assembling the 20 names and their transmission protocols, as well as the actual transmission. A few years ago he would not have thought of making 20 telephone calls or sending 20 notes in a morning's work, but now it was easy to contact the members of the trust group and pass useful information and hunches along to them.

The other reason Vincent had come in to the office early was that he knew he had to begin preparing the speech he was to give the following Monday. While it was a week away, he wouldn't have time later in the week. He was to speak next Monday to the firm's executive committee; the briefing was to take the form of his forecast for the coming year and his roundup of this year's operations. He had given a similar talk in each of his three years in his present job, so he called up the notes from last year's briefing (which were "filed" on the corporate mainframe). Reading through them, he was surprised at how accurate his predictions had been. He decided to pattern this year's talk along the same lines and to be sure to mention the accuracy of last year's forecast.

To make the points he wanted to emphasize at the meeting he would need some recent data on the operations of the trust department and some background economic information. Access to the corporate database was rapid because of his priority user number; once the log-on was complete (executed with a single keystroke), he queried the system for last year's rate of inflation month-by-month, the dollar value of corporate bonds issued week-by-week, and the dollar value of Treasury securities issued week-by-week. He rearranged the tables to his liking (why couldn't the database format reports *his* way?) and pasted them into last year's talk, which would soon be this year's talk.

Vincent remembered the probing questions he had been subjected to at last year's briefing, and he was determined to be ready for them again. He created a file of information which he thought would help him answer the expected questions. Why not include the growth rate diagrams he had used so effectively last year? Quickly he updated them and attached the diagrams to the dataset. He left a note for the computing center manager, explaining that he would need this dataset online for a briefing the following Monday—that would insure that he had priority access to the information, tables, and diagrams from the podium in the boardroom. The new color, large screen projector was capable of much higher resolution than the old one; he would enjoy being able to display his information graphically, and if anyone asked a "what if" question, he was ready to answer it with information in his dataset.

It was almost 9:00 a.m. by the time he had finished the outline for the briefing and stored it in his dataset (it would then be visible on the monitor screen when he gave the briefing). Vincent recalled that he still needed the reservations for his flight the following day. He could have requested ticketing through the corporate travel office, but he hadn't put the request in on Friday and they needed at least two days. A short sequence of keypresses and he was staring at the airline schedules for tomorrow's flights to Chicago. He highlighted the flight he wanted and requested that the ticket be held at the departure gate. While he was online to the airline guide, he decided to check the fares for a planned family vacation. A new, lower fare was available from his preferred airline, but it required a ticket purchase today. He went ahead and bought the tickets; they would arrive in the mail the following day.

Now, he had better get back to his *real* work. He surveyed the latest data from the market and called up his "tickler" file to see if he could take advantage of the steep drop in bond prices. He decided that his anticipation of the situation had kept him a step ahead of the market; he updated the tickler file just as the telephone rang. It was a voice message from John in Customer Relations

(John had probably set the message for delivery in his outgoing voice-mail). John had been contacted by a foundation interested in creating a portfolio and had suggested that Vincent might be the person to contact.

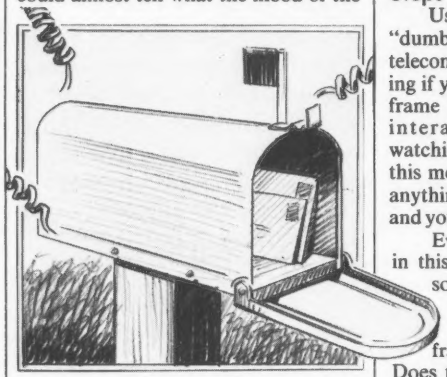
Vincent called up the firm's information on the foundation on his micro screen and noted that a trust officer had called on the foundation only last month; they had not seemed interested in setting up a trust. John had mentioned, however, that a recent windfall to the foundation was the probable cause for the contact. Vincent brought up the newsfile database and queried for stories relating to the foundation. John was correct; the foundation had been endowed by a benefactor only last week. He left a voice message thanking John for the lead and recommendation, and after hanging up quickly typed a note to the foundation's director as listed on the screen. He knew the letter (a hardcopy of what he had typed) would arrive later that day. He also sent a copy of the letter along with a note to the "new business" trust officer (that mail would arrive immediately).

Vincent checked his mail and was surprised by the volume that had accumulated since Friday afternoon. Most of the mail was simply junk which he deleted rapidly. A few of the notes required replies, and he dashed them off quickly. One of the letters was from his counterpart in Denver asking about the new financial instrument introduced last week; Vincent called up a copy of the promotional material and sent it as part of the note to Denver. A series of low tones from the console reminded Vincent that he had a 9:30 appointment.

After the appointment he returned to his micro and requested the investment profiles that had been completed since close of business on Friday. These reports contained the recommendations of the research department; it took a few seconds before the first file arrived from New York. The reports were becoming quite fancy—highlighted at various places in his first report were the specific recommendations of the individual analysts.

Vincent had grown to rely quite heavily on the recommendations of one research analyst in particular, Alice O'Hagan. He moved the pointer to Alice's comments, and they expanded to fill the communications window. Vincent saved them for later use in letters to his clients. This investment report even included a picture of the firm's latest product; Vincent wondered if people really had any use for wrist phones.

It was almost lunchtime when he finished scanning and saving the investment files, and he decided to check the corporate bulletin board before lunch. He pointed to the appropriate icon but was greeted with a lengthy delay; the bulletin board was always the most difficult system to access. What did people do on the bulletin board? Reading the bulletin board was always a great diversion for Vincent, because the messages ranged from the ridiculous to the sublime. You could almost tell what the mood of the



firm was by the types of messages that had been recently posted.

He scanned the entertainment section of the board and found someone willing to sell his basketball tickets for the following Saturday night's game. He would be back in town by then, so he left a note for the seller. After reading through a few of the jokes left by some wag in accounting and the "for sale" ads, he left for lunch.

The Real World

All of the operations performed by Vincent are actually available and in use, but few individuals and organizations have all the capabilities Vincent had. Most of us started out as I did with a new microcomputer, a modem, and a software package chosen more-or-less at random because we really weren't sure what we wanted to do with it.

Few new users know much about personal computer communications when they get their equipment, but they are intrigued by the opportunity to connect with a mainframe or a bulletin board. After putting the pieces together and after a few belated attempts to "hook up" with another system, most of us are successful in contacting a local bulletin board system or our corporate mainframe. Usually we are pretty satisfied with ourselves for a while because we can now work on the mainframe from the comfort of our homes without even warming up the car for the trip to work.

When that first connection takes place we usually begin to realize that we aren't able to do all we thought we could do (or all Vincent could do). That is when we have to begin thinking seriously about what exactly we would want to do and what problems we are likely to encounter.

Steps in Telecomputing

Using your microcomputer as a "dumb" terminal is the first step in telecomputing; that is what you are doing if you call a bulletin board or mainframe timesharing system and simply interact by typing commands and watching the results on your display. In this mode your computer is not saving anything that scrolls across the screen and you cannot accept or send files.

Even connecting to another system in this simplest of all ways can cause some problems. It sounds easy to connect all the microcomputers in an organization to the mainframe, but it really isn't that simple. Does the mainframe have a communication port? At what baud rate does it function? Does it have an even or odd parity (or none)? Does the mainframe supply linefeeds? Can your software communications package adjust to the mainframe configuration? Can your software emulate a terminal?

We would like to be able to download data from the mainframe and insert it into our micro spreadsheets without reentering the data. We'd like to be able to update files on the mainframe from our micros and send electronic mail to anyone in the organization. We'd like a corporate database we could tap into and call up-to-date information from to use on our personal machines. This is the dream, and in some cases, it can be the reality.

Protocol

All communication between computers must take place according to certain ground rules; those ground rules are called the protocol. Communications protocol must be established between the machines before any "talking" takes place. To see why this protocol matching may cause problems, and to see why some communications packages are better than others, requires that we examine a few terms.

In normal communication with an-

other person using the spoken word we must decide who will do what and when. Our informally agreed upon protocol in most situations is simply that when one person is talking, the other person will remain silent and listen. This operational protocol works fine when all parties follow the rules of the game; but when one party decides to interrupt and speak out of turn, the results can be confusing. Part of computer protocol is also deciding who will say what and when. The rules here are not informal and are quite strict (that is, they don't allow for much deviation on anyone's part).

A computer sees information flowing across a telephone line as a series of bits (which may be either 1 or 0) such as:

0010011000111000010101

The bits are interpreted depending upon the protocol of the sending computer. Proper spacing and punctuation are essentially provided by the protocol. Some computers, for instance, read bytes as a set of eight bits; other machines define a byte differently. Traditionally, bytes transmitted over the telephone lines may be either 7 or 8 bits in length. Our microcomputers can be modified with software to accept either configuration, if we know beforehand what we are dealing with.

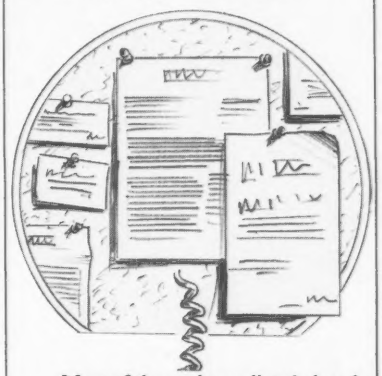
Obviously, the receiving machine must know the byte protocol (7 or 8 bits per byte) or the "letters" will be read differently by machines on either end of the communication. To make things more complex there are special bits (called start and stop bits) which act like spaces between words or meaningful pauses in ordinary conversation. Most of the software packages in our comparison chart easily solve these problems by allowing you to configure to match any computer on the other end of the transmission.

Serious Problems

Serious problems, however, begin when we wish to upload and download files using two different computers (e.g., Apple II to IBM PC, IBM PC to mainframe IBM, Apple II to HP 3000 mini). Since the machines probably use different operating systems and different file structures, uploading and downloading files can be a problem. File transmission is always much more difficult than simple data capture.

Most of the software in our comparison chart handles the task of capturing data through the use of a memory buffer as they come across the screen. When memory is full, the programs write the data to disk in the format of your microcomputer. This, however, is not actually file transfer, since the data are now in the operating format of your receiving machine rather than in the format of the sending machine.

This "capture buffer" system of downloading allows you to save information from bulletin boards and electronic databases, but that information may not be in the exact file structure format you need to be able to use it in another program (like a spreadsheet or statistical package, for example).



Most of the packages listed also allow you to upload information by sending a text file over the telephone line just as if you were typing very quickly the same information on the keyboard. Again, this is not actually a file transfer because the receiving machine is presumably using the capture buffer method of saving the data.

True file transfer (either uploading or downloading) requires both machines to be using the same protocol. That is easy if the machines are identical. The problem arises when the machines on opposite ends of the communication are different.

Even this situation is beginning to be addressed by software manufacturers. Microcom has a package called Era-2 which is available for Apple II series computers, IBM PCs, and Apple Macintoshes. The software uses the same protocol regardless of what machine it is operating from; that protocol is called MNP (Microcom Networking Protocol) and is a standard set by Microcom in the hopes that other manufacturers will accept it and provide packages consistent with it. Plans to support the protocol have already been announced by Apple, Tandy, MCI Mail, GTE Telenet, Dow Jones Information Services, VisiCorp, and Lotus.

What a standard protocol does is allow machines with different operating systems and different processors to pass files (both text and binary) back and forth. Whether this particular protocol will be widely accepted and adopted as the standard remains to be seen.

MNP has recently been adopted by industry giant IBM for its software package the *Personal Communications Manager*, and since Apple Computer had previously accepted the protocol, it seems a good bet that MNP is ahead of other protocols in becoming the *de facto* industry standard. Mainframes can also be included in the MNP protocol; Microcom sells a modem for mainframes which embodies MNP protocol.

A separate protocol that is currently available for users wishing to transfer files with mainframes is Softrans protocol. Softrans.F77 is a Fortran program that runs on many different mainframes and is used in conjunction with two microcomputer communications packages called *Softerm PC* and *Softerm 2*.

The Softrans protocol allows one system to become the active controller while the other becomes the passive respondent. In micro/mainframe communications the micro is always the active controller. The Softrans protocol may also be used between two micros both running *Softerm PC* software with either machine acting as the controller.

Microcomputer Networks

The software needed for a business to set up a microcomputer communications network (perhaps involving mainframes) to transmit data or reports is available now. For example, it is possible for a publisher with salesmen on the road to set up a system in which orders and requests for complimentary copies are recorded on microcomputers carried by the travelers. These orders and requests can then be transmitted to a personal computer (or a mainframe) at the home office each evening (when phone rates are lowest). Management can easily keep track of sales, and orders are filled more rapidly than if mail were used to transmit the requests.

Many business managers are currently making use of electronic information services available on a fee basis. Information utilities like CompuServe, The Source, Dow Jones News/Retrieval, and Newsnet can be very useful for executives with particular information needs. Like Vincent, these executives retrieve information to include in reports and to aid in making decisions.

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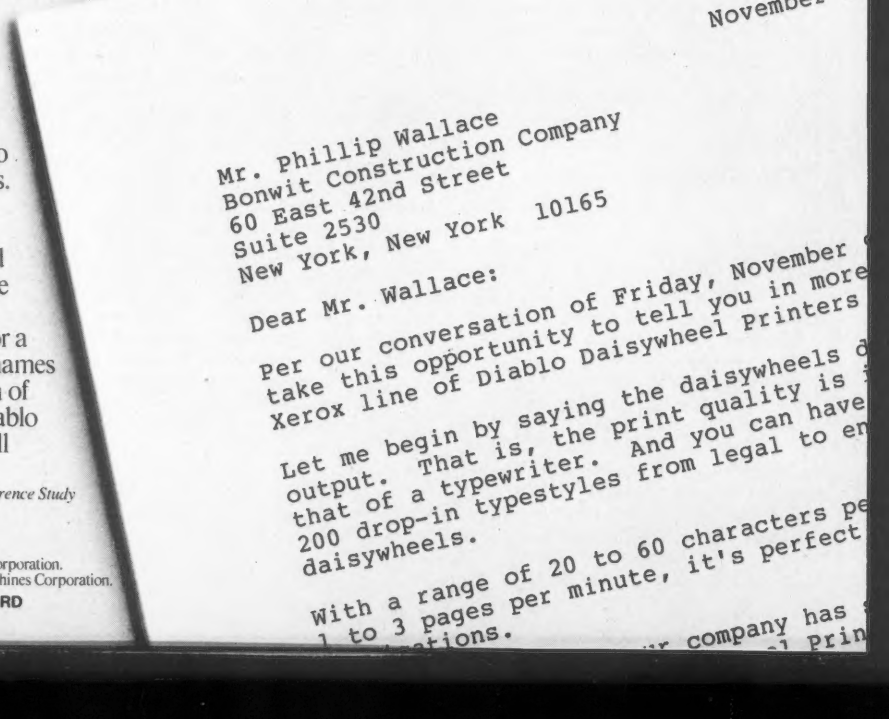
November 12
Mr. Phillip Wallace
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New York, New York 10165
Dear Mr. Wallace:
Per our conversation of Friday, November
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output. That is, the print quality is
that of a typewriter. And you can have
200 drop-in typestyles from legal to en
daisywheels.
With a range of 20 to 60 characters pe
to 3 pages per minute, it's perfect

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*Source *Datamation Magazine 1983 Brand Preference Study* of printer preference by end users and OEM's.

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CIRCLE 184 ON READER SERVICE CARD

XEROX

Dot Matrix Printers
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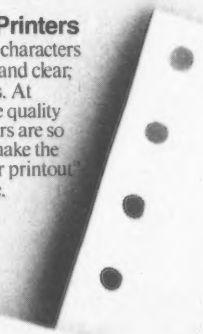

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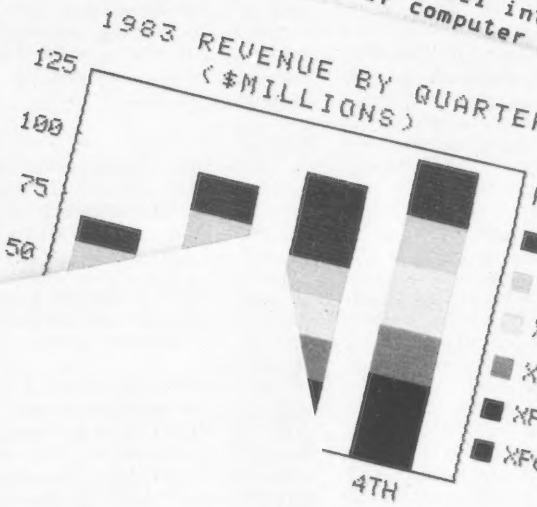
quiet, maintenance-free printers. Their various
designed to provide clear and easy legibility. Th
for long-term reliability to provide you with year
free operation.

Parallel interfaces enable the Dot Matri to work wi
of computer system



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4 WIDE RANGE OF COLOR
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Choosing and Using

Telecommunications Software

Communications Software in Brief

Many communications packages available today could function well in Vincent's ideal world. Seventeen popular packages are reviewed here, and their features compared in a chart at the end of the section.

TermExec

TermExec is a rather complete communications package for the Apple II series of computers with a very small price tag ($95). It is different from most of the other packages we have seen because it relies heavily on the command format of user interface: that means that you tell *TermExec* what you want it to do largely by issuing short commands rather than by choosing items from a menu. This feature makes for very rapid transition from one function to another for frequent users. It is a bit more difficult for infrequent users, but there is always a help screen online.

TermExec supports virtually any modem available for the Apple II series. For Apple IIe and IIc users it displays 80 columns and scrolls 40 columns for II+ computers.

A few features set it apart from the competition in this price range. We found these to be most useful:

- The command format of address.
- Forward *and* backward scrolling buffer (much like HP 3000 series terminals).
- A "timed" set of commands which requires no clock card.
- Remote control.

The scrolling feature allows you to view the last five pages or so of information which have scrolled off the screen; these pages may be scrolled back from where you are in the current terminal session or forward from where you initiated the session. This is a fantastic feature for looking at a previous page to see just what a message said or what command you just used to get a certain result.

The "timed" command actually uses the 6502 processor as a sort of clock card. If, for instance, you wish to send a file to remote computer eight hours from now, *TermExec* can handle the job.

The remote control feature allows your computer to act as a "bulletin board" by answering the telephone and allowing any remote user to use the normal set of *TermExec* commands.

TermExec creates macros (like your own special log-on sequence) in a rather unique way. You place the program in the Learn mode and go through the actual log-on. While you are actually logging on to the remote computer *TermExec* is remembering the sequence of keystrokes you used as well as the time delays between them.

Data Capture

Data Capture comes in versions for IBM and Apple IIe and IIc computers. The package we used was the Apple IIe version, but the materials we received indicated that the IBM version was quite similar. A novel feature of both versions of the unprotected program is that most of the program is written in Basic and is therefore easily modifiable by users with rudimentary programming skills.

Don't misunderstand this feature; the program works quite nicely just the way it comes out of the package, but if you really can't resist...

The name of the program bespeaks its best use: it is meant to be used to capture and transmit information from a remote machine. The program uses a fast menu system which allows you to use a transparent command system once you have become familiar with the package. Just as in *TermExec*, you can skip menus for fast operation and less connect time.

Data Capture uses "one key commands" or macros. Macros are limited to 40 characters.

Of the programs we have tried, this may be the easiest for the novice user. The manual concentrates on explaining how to use the program and includes sections on capturing, merging, printing, writing to disk, editing, transmitting, and listing data. Few users would have difficulty getting this program up and running in short order.

Era-2

One company packages its communications software with a 300/1200 baud modem which incorporates a unique communications protocol. Microcom sells its *Era-2* package in versions for the Apple II series of computers (excluding the Apple IIc) and the IBM PC. It sells a similar combination software/modem package for Macintosh users called *MacModem*.

All three of the Microcom packages incorporate the MNP (Microcom Networking Protocol) which allows any of the three to establish an error-free interactive link with any of the others and also allows file transfer among the three with error checking. It is apparently possible to send files from any of the three to a mainframe if the mainframe is equipped with a Microcom modem.

The package we examined was for the Apple II series. The modem is a Hayes command compatible modem on a board which fits into any of the Apple slots. The modem also has an onboard speaker.

Telenet and Uninet are now offering MNP service to some cities. This service allows error free transmission. These local access numbers are listed in the *Era 2* manual.

Among the advanced features present in the package are:

- Terminal emulation (DEC VT100, VT52, and IBM 3101).
- Very flexible communications settings (compatible with most mainframes).
- Programmable keys (macros).
- Timed communication if you have a clock card.

• Error-free transfers with other micros and mainframes.

• Direct (hardwire) transfers to another micro.

While in terminal (called "interactive") mode in *Era-2* a menu is available with a single keypress. This allows you to move around in the background and work on files or change your communications settings while connected to a remote machine. A Help command explains most of what you may have forgotten from the manual to eliminate time consuming manual reading while online.

The program disk is copyable, so it can be used from a hard disk, and includes setup files for The Source, CompuServe, MCI Mail and Dow Jones News/Retrieval, (a default setting works with EasyLink, RCA Global Communications, and Freedom Network). You can create other setup files for computer systems you call frequently. Loading a setup file is a menu selection.

Softerm

Softerm is aimed at users who wish to emulate certain terminals in order to interact with a mainframe or those who wish to exchange files directly with a mainframe. There is an IBM PC version of *Softerm* and an Apple II series version of the package. (The Apple version includes a board which fits in any slot inside the Apple and provides extra function keys which adhere to the outside of the machine.)

Softerm will emulate more terminals than any package we have seen. There are 24 popular terminals listed, and Softronics claims that all keyboard and display functions are supported. For mainframe/micro communications there is a Softrans protocol which involves putting a Fortran program called Softrans.F77 on your mainframe. The Softrans.F77 program is included on the *Softerm* system disk. Note that the version of Softrans.F77 supplied may require some modifications to work with your mainframe.

The *Softerm* program itself is remarkably versatile, offering keyboard macros, a phone book for autodialing, printer capability, and a complete file utility program. A novel feature is a "communications agent" program which manages both the serial and parallel ports for communications and printing. This communication agent allows you to transfer files over the telephone *while* you print a separate file. Whether this feature will be useful to you depends upon your particular needs.

The program disks are copyable, but you must use an original as a "key" to start the system; this is also true if you use a hard disk—you must have an original of the *Softerm* program in the drive to startup the copy on the hard disk.

MacTerminal and LisaTerminal

MacTerminal and *LisaTerminal* are similar programs. *MacTerminal* runs on both the Macintosh and Lisa (when the Lisa is running MacWorks); *LisaTerminal* runs only on the Lisa. Both programs make extensive use of windows and pulldown menus.

The Softerm program itself is remarkably versatile, offering keyboard macros, a phone book for autodialing, printer capability, and a complete file utility program.

Both programs are full featured in that they allow the saving of material coming across the screen, terminal emulation, and a full range of communications parameters. With extra hardware both can emulate an IBM 3278, but in most uses a 300 or 1200 baud modem would be used with the terminal program set to emulate a DEC100. The programs create "documents" which are shown on the screen as icons when the disk boots. Each of these documents can contain the parameters for a different remote system and a record of the last communication with that system.

The entire communication with another computer takes place "within" a document. The menu bar remains at the top of the screen and is accessible at all times, while the cursor indicates the position of incoming and outgoing data. The mouse may be used on the righthand side of the screen to position a "scroll bar" so that you can read things that have already scrolled off the screen. Scrolling can be smooth or page-by-page. Once you have a document set up, you can save it to disk and it will be available with the same communications settings the next time you choose the icon that represents it.

Parts or all of the text which has scrolled over the screen during a session can be saved or placed on the clipboard for transfer to another document in *MacWrite* or *LisaWrite*. It is also possible to print part or all of the captured material. At all times the Apple menu is available with its calculator, clock, and various other utilities.

One shortcoming of both programs is the lack of a redial feature. This is perhaps a function of the modems which can be used with each machine, but it is annoying in these days of busy computer numbers. Another flaw that became obvious after some use is that neither package allows you to build macros.

Finally a word about the manuals accompanying *MacTerminal* and *LisaTerminal*: both are very easy to read and quite complete in their examples. A novice will have little trouble setting up the hardware and beginning to use either package.

PFS:Access

PFS:Access is designed primarily for those who wish to contact an information utility to download information and perhaps print it. It is not designed to be used primarily as a terminal emulator, nor does it allow the wide range of communications protocols supported by some of the other packages.

It is designed to handle without hassles the calling of an information utility (like The Source), an automatic log-on, and the saving of information flowing across the screen. The single copy protected disk (which allows you to make one copy only) comes set up to handle CompuServe, Dow Jones, EasyLink, MCI Mail, and The Source.

You may also set up three additional communications settings for other services. Once the automatic log-on has been set up, you simply select an information utility from the menu, and log-on is completed with only one or two keystrokes.

Material that has already passed over the screen is easily viewed by scrolling, and information may be saved with a privacy code if desired.

Potential purchasers should note that *PFS:Access* is able to save only files readable by *PFS:Write*. You may not be able to use another word processor to read and edit these files. Also note that the Apple version of this program is for the Apple IIe or IIc (not the II+) and that it is incompatible with many popular modems.

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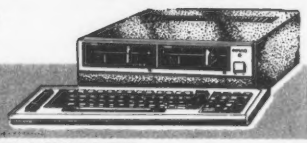

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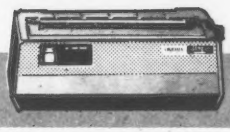

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PC/InterComm

PC/InterComm is billed as a terminal emulator and that is its strong point; it emulates either a VT100 or VT102 terminal. At $99 it provides a good value with many features found on only the more expensive packages. Our only difficulty with *PC/InterComm* was that the manual, while short and to the point, was a little too short in some places and seemed to assume that the reader was an experienced telecommunicator.

The single disk is not copy protected, so it can be used with a hard disk. Your modem can be connected to either COM1 or COM2. The program makes it easy to set up the protocol for the computer you are calling from a menu and save it as a file for later use. You can also define 30 function keys with macros.

Any screen can be dumped to a printer at any time (a useful feature), or you can save long files of information that have come across the screen. The capture buffer can be viewed by scrolling. A 25th line at the bottom of the screen displays useful status information.

Perfect Link

The *Perfect Link* software package is, indeed, perfect for those with little telecomputing experience who want a package with a detailed and readable manual combined with a powerful communications program. For the IBM, *Perfect Link* includes a single disk and two cardboard overlays for the function keys.

While the package is designed for users new to telecomputing, it also includes features which allow it to converse with most microcomputers and mainframes. It will, for instance, emulate a VT52 or IBM 3101 among others.

The manual begins with the assumption that you are a new user totally unfamiliar with modems and communications, and that theme is carried throughout the manual. There are also technical chapters and appendices which belie the impression of simplicity. An entire chapter explains, for instance, how to connect your IBM with other micros.

In a feature unusual among communications manuals, the *Perfect Link* manual has a separate chapter describing six information utilities: Dow Jones News Retrieval, CompuServe, The Source, Official Airlines Guide, NewsNet, and Knowledge Index.

Perfect Link allows you to create programmable keys (macros), and its online file handling abilities are admirable. You may list the directory, rename files, or list the files—all while connected to a remote machine. Please note, however, that *Perfect Link* requires two disk drives.

ASCII Express

The manual for *ASCII Express* calls the software the "most sophisticated communications software available for the Apple computer," a claim which is certainly not far from the truth. *ASCII Express* has been around in one form or another for quite some time; it has been updated from time to time, and the latest version includes most of the options an Apple computer owner might need for telecommunications.

The secret of ASCII Express is probably its completeness. Regardless of what situation you may encounter, no matter what communications problem you dread, ASCII Express can probably handle it.

Many of the options in *ASCII Express* are simply not available in many other communications packages.

Why has this program survived while others have come and gone? It is probably not because it is the easiest program to use or because it is the fastest program around. The secret of *ASCII Express* is probably its completeness. Regardless of what situation you may encounter, no matter what problem in communications you dread, *ASCII Express* can probably handle it.

The program is supplied on a double sided disk with the main program and utilities on one side and the less used materials on the other.

The disk is not copy protected (hard disk users note) and so serves as your archival copy. A complete tutorial is included in the manual.

Two menus contain most of the information on the commands. In addition, new users will appreciate the help feature, which explains each of the available commands in detail. While *ASCII Express* is a menu driven system, users familiar with the system can save time by issuing commands directly.

A full editor can be used either on- or offline. It is the most complete editor we have seen in a communications package—not quite a word processor, but close.

A capture buffer can be toggled on or off. You can increase or decrease the viewing speed, a feature that is especially helpful when you wish to skim past a large section of the buffer in search of one small item. Anything coming across the screen can be saved to the buffer, and files can be transmitted using an error checking protocol.

For uploading information to a remote system *ASCII Express* has features to overcome most problems: nulls are available to put delays between the lines; the transmission speed can be slowed down if the remote machine is unable to accept characters at the full baud rate; a prompted send is available allowing *ASCII Express* to wait for any character before sending the next line; character supression or filtering can remove unwanted characters sent by any remote system; protocols or configurations can be changed while online.

A remote mode allows you to use *ASCII Express* from a remote machine. You could, for instance, boot up *ASCII Express* and put it in remote mode with a text file on the disk in the drive. A remote user could dial your machine, ask for the file, catalog the disk, change disk drives, or view any text file on the disk.

A powerful set of macro commands allows you to do many things with single keystrokes. Macros can be linked to one another and may include conditional statements.

Apple Access II

Apple Access II was designed specifically to take advantage of the features of the Apple IIe and IIc machines; it is *not* intended for use with the older Apple II+ machine. It is the only package in our survey based on the Apple ProDOS operating system.

The *Apple Access II* package makes start up simple by providing a separate tutorial disk with an interactive program.

Access II uses a menu system which displays the menus in a fashion similar to the popular *Appleworks* package—that is, they look like notecards placed on top of one another as new menus are chosen. This feature makes it easy to see exactly where you are. The program supports autodial modems and has the ability to handle automatic log-ons. Sample

automatic log-on files are supplied for Dow Jones, Compuserve, and The Source. Since there is no line editor in *Access II*, however, you must use a word processing package to insert your own password and ID to make these files complete.

The absence of a line editor also means that although the program can capture data as it comes across the screen or one file at a time, it is impossible to review information which has scrolled off the screen. The capture buffer is about 3000 characters long. For short files, obviously, there is no problem, but saving longer files can be complicated, and the absence of a common protocol, discouraging.

Help screens are available on *Access II*, and you can use the file utilities while online. Printing is simple. Configurations for remote computers are stored in files and called when needed; it appears that just about any configuration can be simulated.

The *Access II* manual is exceptionally well written and includes many step-by-step examples.

Crosstalk

Crosstalk XVI is one of the best selling communications packages for the IBM PC, AT, and jr. Other versions are available for CP/M machines.

The program is provided on a single, copyable disk (the actual files take up about 90K on the disk leaving considerable room for your own files). It is an impressive product which is complete in the same sense that *ASCII Express* is complete for the Apple. Both are mature products which have stood the test of time in the market and proven popular with a wide range of buyers because they are able to adapt to most communications situations. *Crosstalk* provides the basic terminal emulation routines, but it also has the more advanced features you expect in a complete communications package.

The manual for *Crosstalk* is a professional publication with tutorials as well as the standard reference sections. Actual photographs of screens enhance the manual and make it easier to understand the many features of the program. There are also help files on the disk.

Functions can be invoked either with a menu system or, more often, by issuing direct commands. Most often, *Crosstalk* will be used from the keyboard, but there are other options. You can also command the program from "command files" and "script files"; both hold details of what you want the program to do.

A script file is like the script of a play in the sense that it tells *Crosstalk* what you expect it to do. An entire exchange with another remote computer can be handled with the 17 words (commands) available for use in a script file. A command file contains the setup required to begin communications with another computer.

Crosstalk offers the ability to review the capture buffer on-line (in a 128K machine, the capture buffer is a rather large 66K) and will automatically save the buffer when full. The capture buffer can be on continuously, or you can save only a screen at a time.

PC-Dial is like PC-Talk III in that it is freeware; you are encouraged to copy the software and share it with others.

A filter allows incoming data to be screened for unwanted characters, which can be deleted. *Crosstalk* is one of only a few programs we have seen which allows you to define the background color of the screen (if you have a color system). Microstuf provides a customer support telephone (voice) line to answer questions.

PC-Talk III

This program is free! That's correct; *PC-Talk III* is a piece of "freeware," and while Headlands Press no longer sends out free copies, many bulletin boards will let you download the program free. Users' groups also are a source of *PC-Talk III*.

Since it's free, you might be inclined to think that this IBM program would not stand up to close comparison with other communications software. That would be a mistake. If you find the program useful, you are asked to send Andy Flugelman (the author) $35, and many people are finding *PC-Talk III* useful. It is a good program that will run on a 64K IBM. The "manual" comes on the disk; the program supports most communications protocols; communications protocol setup files (dialing directories) are utilized; and it supports the XMODEM error checking protocol. Other IBM communications packages must really be good to compete because it is hard to compete with Santa Claus when Santa is providing such a dandy product.

PC-Dial

PC-Dial is another very inexpensive IBM package; this one written by Jim Button. It is provided on an unprotected disk and is supplied with a manual.

PC-Dial is like *PC-Talk III* in that it is a freeware; you are encouraged to copy the software and share it with others. If you find the program useful, you are asked to send Jim Button $29. The $29 payment will get you the printed user's guide and notification of new products.

The program itself uses XMODEM error checking; has an auto redial feature; has the ability to "filter" incoming data; can capture incoming data continuously or a screen at a time; builds automatic log-on sequences; and will adapt to most communications protocols. The program runs on a 64K IBM with PC-DOS 1.0, 1.1 or on larger machines with 2.0 or later.

Transend

Transend PC is the only program you will need to set up an electronic mail network operating over telephone lines in either attended or unattended (timed) mode. The clear strength of this program is electronic mail. It is even designed to look a bit like a mailroom with "in baskets" and "out baskets" to hold pieces of mail.

You can create messages using *Transend* or you can transmit data already formulated in programs like *VisiCalc* or *1-2-3*. Messages are stored temporarily in baskets which appear on the screen much like Lisa or Macintosh windows (*Transend* does a credible job of simulating a windowed environment even though it is actually a menu driven program. The window effect will be especially pleasant for those with little computer experience with electronic mail). Addresses are appended to the various pieces of "mail" from an address book previously stored on the system. The messages can be sent immediately, or the system can be commanded to wait until a certain time for transmission.

The "in basket" works in much the same way. *Transend* waits for calls and accepts mail from other IBMs also running *Transend*. It then stores the "mail" in a basket for later review and/or printing.

The desktop style of the program is quite well done, and it is easy to visualize what is going on without knowing a

thing about how files are stored or where precisely they are at any point in time.

To allow business users to create their own long distance electronic mail networks, the manual includes instructions on how to use *Transend* with The Source to set up a network. Instructions are also included for setting up a local network without going through The Source but just using *Transend* to *Transend*. These instructions should have you up and running on your own network quickly.

Transend can, of course, communicate directly with other machines and information utilities, although it does seem directed toward electronic mail users.

Networks

Networks for the Apple II series and *E-Mail* for the IBM are not actually communications packages as such. They do *not* allow you to use your computer as a terminal, but they do allow you to use your computer in a quite different way.

Both programs allow you to set up your computer to resemble the electronic equivalent of the cork bulletin board you might see in a supermarket. It is likely that there are a few public bulletin boards in your local calling area; it is also likely that one of them is running one of these software packages.

Jones Engineering actually developed *E-Mail* for the purpose of keeping in contact with its clients and trading questions and answers with them in a timely fashion.

E-Mail and *Networks* are provided on single unprotected disks. Both are modifiable at the user's option. Both are designed to be an electronic mail facility featuring the ability to transfer letters, documents, or ASCII text files from the central bulletin board to multiple locations or vice versa. The bulletin board is a "hub" through which messages may be sent—sort of an electronic Federal Express.

Both programs create a log of callers, which includes the time and date they called, the caller's connect time, and other bits of information about the call. Both programs work at only 300 baud. *Networks* will work with one disk drive (but requires more drives for sophisticated use), while *E-Mail* requires two drives.

For callers, both programs are extremely simple to use. We doubt if anyone could fail to understand the complete set of commands after one call. ■

COMMUNICATIONS

	Transend PC	TermExec	Data Capture IIe	Data Capture PC	Networks II
Host Personal Computer	IBM PC	Apple II	Apple IIe	IBM PC	Apple II
User Interface	"Desktop"/ Menu	Command/ Online Help	Menu/ Command	Menu/ Command	Menu
Macros/Automatic Log-on	Yes	Yes ("Learn")	Yes	Yes	—
Print Capability	Yes	Yes	Yes	Yes	Yes
Provides Buffer	Yes	Yes	Yes	Yes	—
Line Editor	Yes	Yes	Yes	Yes	Yes
Buffer Review Online	Yes	Yes	Yes	Yes	—
Online File Management (Catalog, del., esc.)	Yes	Yes	Yes	Yes	—
Error Checking	Yes	Yes	No	No	No
Transmit/Receive ASCII Files	Yes	Yes	Yes	Yes	Yes
Terminal Emulation	No	No	No	No	—
Time Sequencing	Yes-with clock	Yes-with no clock	No	No	—
Stores Parameters of Remote	Yes	Yes	Yes	Yes	Yes
Auto-Redial when Busy	Yes	No	No	No	—
Autoanswer	Yes	Yes	Yes	Yes	Yes
Remote Control	Yes	Yes	No	No	Yes
Drives Required	1	1	1	1	1
Pages in Manual	137	99	69		On Disk
Copy Protected	Yes	No	No	No	No
Quick Referencing Card or Help	Online	Online	Online	Online	Online
Price	$189	$95	$90	$120	$89

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(408) 996-1010

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Buttonware
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Bellevue, WA 98006
(206) 746-4296

TermExec
Exec Software
201 Waltham St.
Lexington, MA 02173
(617) 641-2930

PC-Talk III
Headlands Press, Inc.
P.O. Box 862
Tiburon, CA 94920
(415) 435-9775

Networks
High Technology
P.O. Box 60406
1611 N.W. 23rd St.
Oklahoma City, OK 73146
(405) 524-4359

E-Mail
Jones Engineering Associates, Inc.
P.O. Box 26134
Charlotte, NC 28221
(704) 455-9616

PC/InterComm
Mark of the Unicorn, Inc.
222 Third St.
Cambridge, MA 02142
(617) 576-2760

Era-2
Microcom Inc.
1400A Providence Highway
Norwood, MA 02062
(617) 762-9310

SOFTWARE COMPARISON CHART

	ASCII Express Pro	PC-Dial	PFS:Access	Era 2	Macterminal	Apple Access II	Crosstalk XVI	PC/Intercomm	Softerm PC Softerm 2	Perfect Link	LisaTerminal	E-Mail
	Apple II	IBM	Apple II/ IBM	Macintosh Apple II/IBM	Macintosh/ Lisa	Apple IIe and IIc	IBM	IBM	IBM/ Apple II	IBM	Lisa	IBM
	Command/ Online Help	Menu	Menu	Menu	Pulldown Menus	Menu	Menu/ Command	Menu	Menu	Menu	Pulldown Menus	Menu
	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes/No	Yes	Yes	No	—
	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—
	Yes	No	No	No	Yes	No	No	No	No	No	Yes	Yes
	Yes	No	Yes	No	Yes	No	Yes	Yes	No	No	Yes	—
	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	—
	Yes	Yes	No	Yes (MNP)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—
	No	No	No	Yes-with clock	No	No	No	No	Yes	No	No	—
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	No	No	No	No	Yes	No	Yes	No	No	—
	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No	Yes
	1	1	1	1	1	1	1	1	1	1	1	2
	338	17	76	224	116	195	182	86	461	398	82	106
	No Online	No Yes	Yes Online	No Yes/Online	Yes Online	No Yes/Online	No Online	No Online	Yes Online	No Online	Yes Online	No Online
	$129.95	$25	Apple IIe- $70 IBM $95	Apple II $499 IBM/PC jr. $499 Macintosh $599 (with Modem)	$99	$75	$195	$99	IBM $295 Apple $195	$129	$695 (includes integrated software)	$99.95

PRODUCTS AND SERVICES

Crosstalk XVI
Microstuf Inc.
1000 Holcomb Woods Pky.
Suite 440
Roswell, GA 30076
(404) 998-7798

Softerm PC
Softerm 2
Softronics Inc.
3639 New Getwell Rd.
Memphis, TN 38118
(901) 683-6850

PFS Access
Software Publishing Corporation
1901 Landings Dr.
Mountain View, CA 94043
(415) 962-8910

Data Capture IIe
Data Capture PC
Southeastern Software
7743 Briarwood Dr.
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Thorn EMI Computer Software, Inc.
3187 C Airway Ave.
Costa Mesa, CA 92626
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Transend
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High-Resolution And Color Liquid Crystal Displays

David H. Ahl

Experimental color liquid crystal display shown actual size (4.25″ diagonal).

The technology of liquid crystal displays (LCD) is just 13 years old. Yet in that short period of time the sales of LCD devices have surpassed the sales of all other display technologies combined, save one, the venerable cathode ray tube (CRT). Now, however, with the advent of large area, high density LCDs and full color, it appears that even the CRT may be in danger of being overtaken by the LCD. What are the advances that have made this possible?

Initially, LCDs were small—use in watches was and is still the most common application—and resolution was relatively low. Early displays of the mid- and late 70's had fewer than 100 pixels (picture elements or dots) in an area of five square centimeters.

The basic technology for most LCDs is known as twisted-nematic (TN). Liquid crystals are sandwiched between polarizers which are placed at 90-degree angles to one another (see Figure 1). When the current is off, the crystals fall into a pattern of layers, twisting through 90 degrees from the bottom to the top layer, parallel to the plane of the display. In this orientation, light may be transmitted (actually reflected) through the crystals. To the viewer, this appears white or light gray. When the current is on, the crystals are forced perpendicular to the plane of the display, and the polarized light passes around the crystals and is absorbed by the top polarizer; this appears black (or dark).

Electrodes invisible to the eye are deposited on the two surfaces of the glass between which the liquid crystals reside (see Figure 2). One layer of glass contains the X lines, sometimes called the data lines; while the other surface contains the Y lines, sometimes called the scanning lines. This is the approach used in most LCDs as it is the lowest cost method of construction and permits a fairly large display to be constructed.

Unfortunately, the resolution of such a display is limited because as more electrode lines are etched into the glass, the contrast ratio and viewing angle worsens. Figure 3 shows a monochrome 200 x 640 pixel display—about the upper limit of this technology. This is equivalent in size and cost to about a 9″ high-resolution monochrome CRT display. Displays such as this are found on the Data General/One and other recently announced systems.

Active Matrix Displays

To overcome the resolution, contrast, and viewing angle limitations of standard TN technology, two methods are currently under development, both of which use active elements in the display itself. In these methods, there is one active element for each pixel in the display, and each element holds the data for its corresponding pixel.

One method is known as a Metal-Insulator-Metal (MIM) structure device (see Figure 4). A MIM element consists of thin tantalum-pentoxide layer (insulator) between two metal layers. This device has characteristics similar to a bi-directional diode. In other words, below a certain threshold voltage, the device acts as an insulator; above the threshold, current flows freely.

Since a MIM device has only two states (on and off), it is quite suitable for a monochrome computer display, but not for a television display which requires levels of gray. Since electrode lines are engraved in only one glass surface, MIM LCDs can produce high-contrast, high-resolution images that can be viewed at relatively wide angles.

Figure 5 shows an experimental MIM LCD developed by Epson and Suwa Seikosha. It has a 240 x 250 pixel matrix in an area of about 3.7″ x 3.9″.

The second active matrix LCD technology uses nearly invisible thin film transistors (TFT) deposited on one glass surface. Normally, transistors are fabricated on a single crystal wafer. However researchers developed a method for depositing them on the glass substrate (see Figure 6).

When a TFT is turned on, a charge is stored in the TFT that will continue to drive the liquid crystal materials corresponding to that pixel until the next signal is received. Since the TFT acts as a memory device rather than a switching device or a diode, it can hold a charge to produce various levels of gray and is thus suitable for television use. Furthermore, there are no electrodes etched into the glass at all, thus reducing the limitations on resolution and viewing angle. On the other hand, the fabrication process is quite complicated, and the largest commercial TFT devices produced thus

Note: This article was developed with the aid of material furnished by Shinji Morozumi, Manager of the Fundamental Technologies Research Development Department of the Suwa Seiko-Epson Group.

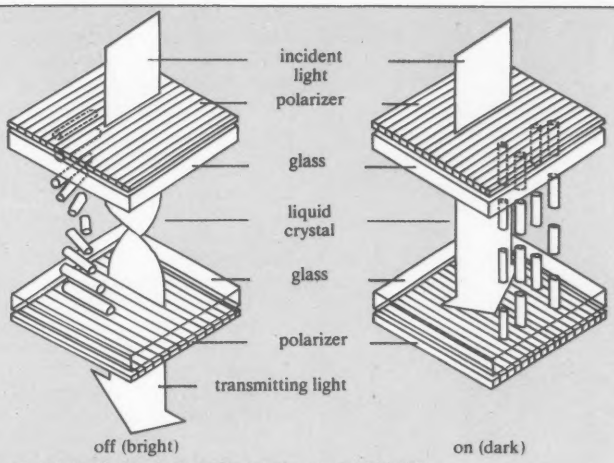

Figure 1. Principal of operation of twisted-nematic (TN) LCD.

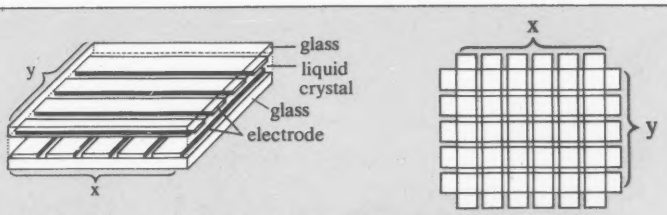

Figure 2. Electrodes are deposited on the glass surfaces in perpendicular directions.

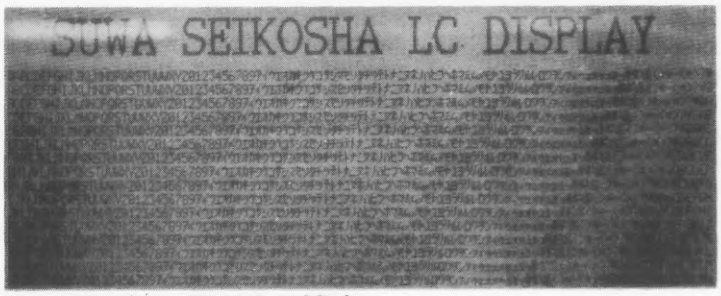

Figure 3. Monochrome 200 x 640 pixel display.

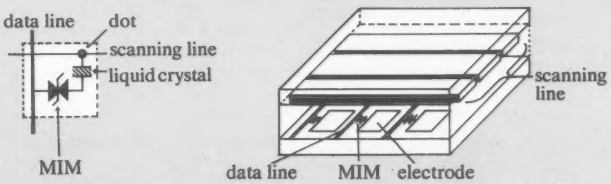

Figure 4. In MIM LCDs, bi-directional diodes are deposited on one glass surface.

In the next five years, large area color LCDs could surpass CRTs in sales.

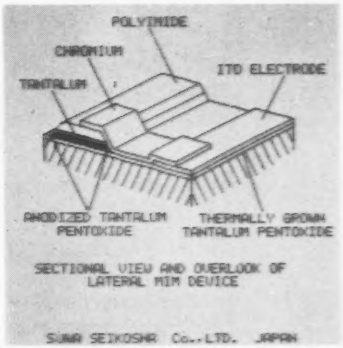

Figure 5. Experimental MIM LCD has 240 x 250 pixel matrix.

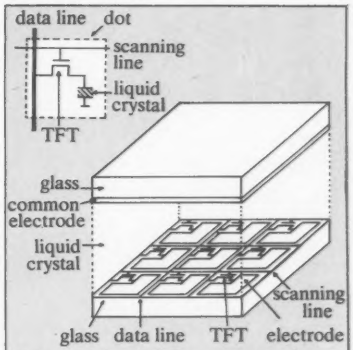

Figure 6. In TFT LCDs, each pixel has a corresponding thin film transistor deposited on one glass surface.

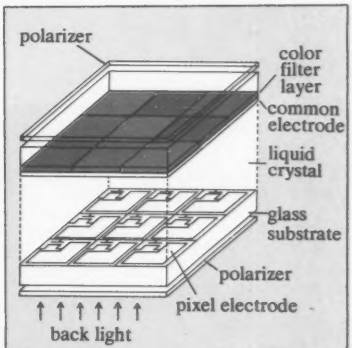

Figure 7. Structure of a full color TFT LCD.

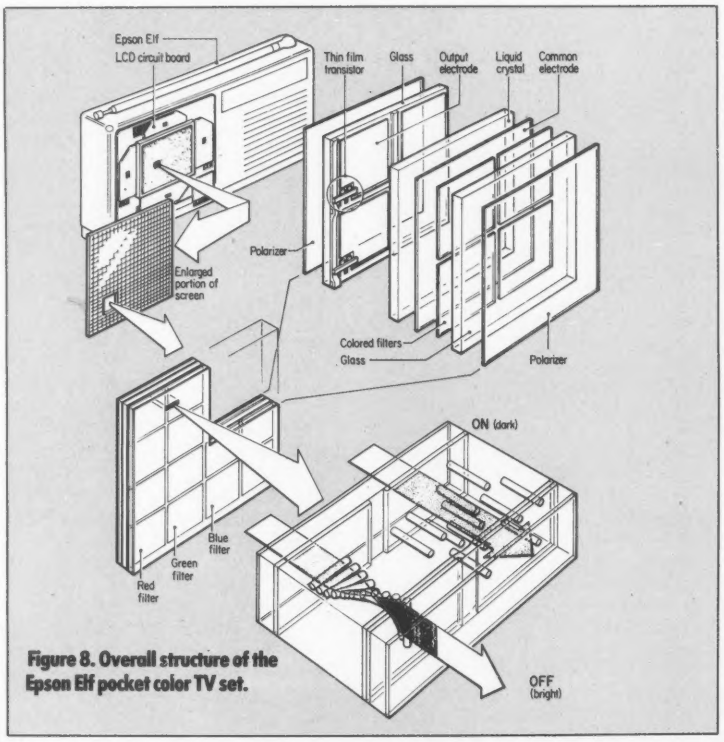

Figure 8. Overall structure of the Epson Elf pocket color TV set.

Figure 9. Epson Elf TV set has a resolution of 220 x 240 pixels in a 2" x 2" screen.

Resolution of Selected LCD Displays

Pixels/ sq. cm.	*Size (sq. cm.)*	*Date*	*Tech-nology*	*Item*
20	5	Mid 70's	TN	Watch and calculator displays
158	97	1982	TN	Tandy Model 100/NEC 8201
528	310	1984	TN	Data General/One
644	93	1984	MIM	Experimental (monochrome)*
2046	26	1984	TFT	Epson Elf pocket color TV set
4039	57	1985	TFT	Experimental (color)*

* Experimental displays produced by Suwa Seikosha/Epson Group

far are only about 2" square.

A further advantage to TFT technology is that it can be used to construct integrated circuits for the display driver and interface right on the same glass substrate, thus lowering the overall cost of the device.

Color Graphics

Theoretically, any of the above LCD fabrication technologies could be used to produce a color display with the addition of red, green, and blue filters. However, because of its high resolution, gray scales, and wide viewing angle, the TFT technology is the most suitable.

Figure 7 shows the structure of a portion of a color display. Between the upper glass and the common electrode is an additional layer containing a checkerboard pattern of colored filters, one for each pixel, alternating red, green, and blue. Unlike monochrome LCDs, which utilize reflected light, a color LCD must have a white light source behind the display. The LCD layer acts as a shutter and transmits all, a portion, or none of the filtered light through each pixel.

This is the technique that has been used in the Epson Elf pocket color television (see Figures 8 and 9), the first commercial color LCD television. It has a resolution of 220 x 240 pixels (52,800 pixels) in an area 2" square.

An experimental color LCD 3.4" x 2.6" (4.25" diagonal) has been constructed with 230,400 pixels, more than four times the number on the television display (see title illustration). This display is only about 15% smaller than a 5" CRT; thus we can expect to see it available for both computer and television applications.

Down the Road

In the near future, 400 x 640 monochrome LCDs will be widely available at prices rivaling those of CRTs. And within the next five years engineers expect to be able to produce very high-resolution monochrome LCDs (over 1000 x 1000 pixels) at reasonable cost.

Furthermore, it is likely that 200 x 640 color LCDs will be introduced within a few years. However, until production levels increase substantially, such color displays will cost considerably more than their CRT counterparts. On the other hand, if enough people want flat screen TVs for their homes, production levels could increase rapidly, and such displays could be commonplace on both television sets and computer displays by 1990. ■

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212A Modem Comparison Chart *

STANDARD FEATURES	PRO	HAYES STACK	NOVATION SMARTCAT+	ANCHOR 1200	US ROBOTICS PASSWORD
300/1200 Baud (212A)	✓	✓	✓	✓	✓
Intelligent Microprocessor	✓	✓	✓	✓	✓
Tone and Pulse Dialing	✓	✓	✓	✓	✓
Hayes Command Compatible (Works with Smartcom®)	✓	✓	✓	✓	
Additional telephone jack with exclusion switching	✓			✓	
Analog loop back self test	✓	✓	✓		
Self Test at Power Up	✓		✓		
Call Progress Detection (Busy, Dial Tones, Trunk Busy, etc.)	✓		✓		
Speaker and External Volume Control	✓	✓	✓		
Full Complement of Status Lights	✓	✓			
8 Switch Selectable power-up defaults	✓	✓			
Adaptive Dialing	✓		✓		
Auto Redial on Busy	✓		✓		
Ergonomically designed easy to read front display panel	✓				
Internal Stand-Alone Power Supply	✓				
Built in Real Time Clock/Calendar	✓				
Help Command	✓				
300 baud connect while maintaining 1200 baud RS-232 link	✓				

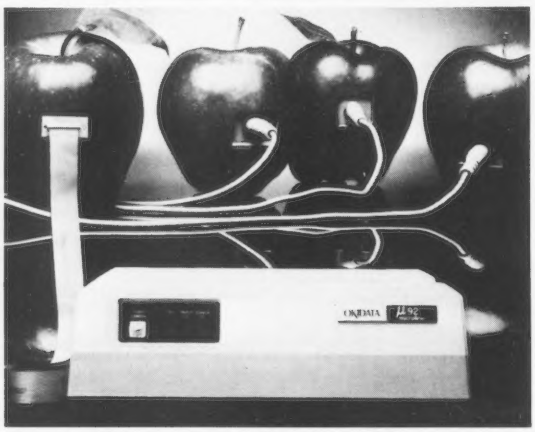
EXPANDABLE OPTIONS	
Automatic Receiver Buffer	
Automatic Transmit Buffer	
On-board Personal/Business Directory	
Buffer, Expandable to 64K	
Auto Logon Macros	
Auto message transmission to groups of numbers	
Records call duration	
12-character Alphanumeric Display	

*Comparison made by Prometheus on the basis of the best information available to Prometheus at time of printing.

CIRCLE 195 ON READER SERVICE CARD

What's New In Hardware

Russ Lockwood



Apple-Compatible Okidata Printers

Okidata Microline 92 and 93 printers can be ordered fully factory configured for the Apple Macintosh, Lisa, and IIc computers. The ML92 costs $569; the ML93 costs $869. A $29.95 computer-specific Okidata cable is also needed.

The ML92 and ML93 require a $99 Apple Plug 'N Play kit to connect to an Apple II+ or IIe.

Okidata
532 Fellowship Rd.
Mt. Laurel, NJ 08054
(609) 235-2600

CIRCLE **423** ON READER SERVICE CARD

Portable Computer

Sanyo has introduced the MBC 775, an IBM PC compatible color portable computer built around a 16-bit 8088 microprocessor. It features 256K RAM expandable to 640K, two 360K, 5.25" floppy disk drives, a detachable keyboard, a Centronics parallel port, and two expansion slots.

The built-in color graphics board provides text resolution of 25 lines of 80 characters and graphics resolution of 640 x 200 pixels from a palette of 16 colors. The MBC 775 runs MS-DOS 2.11 and comes with Microsoft GW Basic. It carries a retail price of $2599.

Sanyo
51 Joseph St.
P.O. Box 387
Moonachie, NJ 07074
(201) 440-9300

CIRCLE **424** ON READER SERVICE CARD

2400 Baud Modems

US Robotics has introduced the Courier, an external 2400 baud modem, and the Microlink, an internal 2400 baud modem, for use with IBM PC and AT and compatibles. Both can communicate at 1200 and 300 baud as well.

Features included are autodial and autoanswer functions, compatibility with *Crosstalk*, *Smartcom*, and *PC Talk* communications software, and a self-test mode. US Robotics also includes its Telpac communications software with the modem.

Both Courier and Microlink carry a suggested retail price of $895.

US Robotics
1123 W. Washington Blvd.
Chicago, IL 60607
(312) 733-0497

CIRCLE **425** ON READER SERVICE CARD

Plotters and Digitizer Pad

Houston Instrument has introduced the PC Plotter 595 and PC Plotter 695. Both feature a four-pen carousel, pen speed up to 4.2" per second diagonal, and an RS-232C serial interface. Both are compatible with dozens of graphics programs, including *Lotus 1-2-3*, *Keychart*, and *pfs:Graph*.

The PC Plotter 595 produces graphics on 8.5" x 11" paper and costs $595. The PC Plotter 695 produces graphics on either 8.5" x 11" paper or 11" x 17" paper and sells for $695.

Houston Instrument has also unveiled PC Pad, a digitizer graphics tablet with a 5" x 5" drawing area that addresses graphics resolution of up to 1024 x 1024 pixels on a computer screen. It can also double as a mouse. The unit connects to a computer via an RS-232C serial port. The PC Pad retails for $395.

Houston Instrument
P.O. Box 15720
Austin, TX 78761
(512) 835-0900

CIRCLE **426** ON READER SERVICE CARD

SO YOU THINK YOU GOT THE BEST OF FROGGER AND ZAXXON? SORRY.

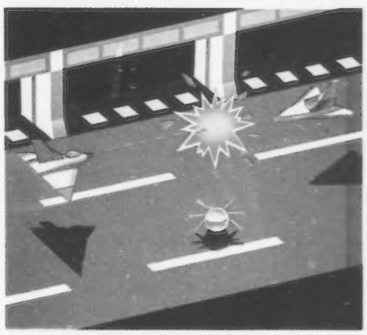
See, while you've been mastering them, we've been advancing them. Making them even more fun than before. So now we have two new mindblasters.

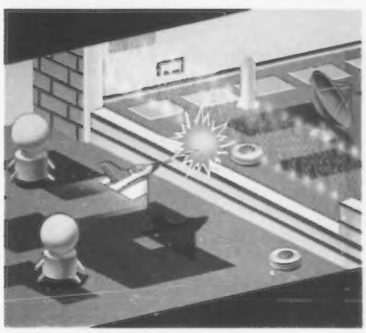
Frogger II Threee-Deep, a three-screen nightmare. Starting with an undersea battle against deadly creatures and the cruel undercurrent. If you do make it to the surface, it just gets worse. The only hope is to leap into the sky where even more frog-eating monsters lurk.

And Super Zaxxon, taking you beyond the outer limits in your space fighter. Tunneling through enemy attack, firing at Zaxxon's forces, dodging mine layers.

And beyond the last electron barrier, the ultimate test. Zaxxon is now a killer dragon hurtling heat-seeking fireballs.

Hope we haven't scared you. But if Sega doesn't keep you ahead of the game, who will?



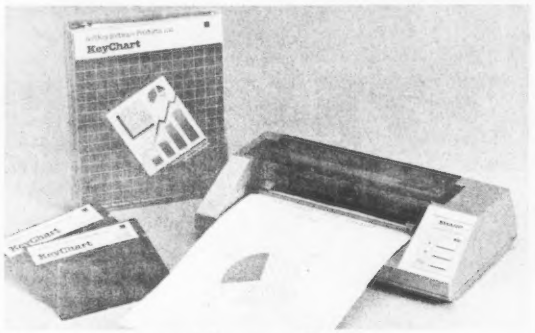


Atari 2600	Atari 5200	Atari Computers Cartridge	Atari Computers Diskette	Commodore 64 Cartridge	Commodore 64 Diskette	ColecoVision & ADAM	Apple II's	IBM PC	✓Sega Enterprises, Inc. ✓Parker Brothers ✓HesWare
NEW ✓	NEW ✓	NEW ✓	NEW ✓	NEW ✓	NEW ✓	NEW ✓	NEW ✓	NEW ✓	FROGGER II
		NEW ✓	NEW ✓	NEW ✓	NEW ✓		NEW ✓	NEW ✓	SUPER ZAXXON

©1985 Sega Enterprises, Inc. FROGGER is a trademark of Sega Enterprises, Inc. THREEEDEEP is a trademark of Parker Brothers. ZAXXON is a trademark of Sega Enterprises, Inc. Game screens are illustrated.

INTRODUCING FROGGER II THREEEDEEP AND SUPER ZAXXON.

CIRCLE 154 ON READER SERVICE CARD



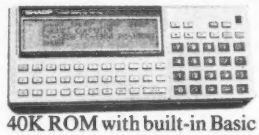
Peripherals and Pocket Computers

Sharp Electronics has released the CE-515P, a four-color, letter-size plotter with RS-232C serial and Centronics parallel interfaces. It prints in black, blue, green, and red, accepts paper up to 8.5" wide, and can plot on overhead projector transparencies and postcard size documents.

The CE-515P is bundled with *Keychart*, a presentation graphics program that draws data from spreadsheet packages such as *Lotus 1-2-3*, *SuperCalc*, *VisiCalc*, *MultiPlan*, and *PeachCalc*. Versions for the IBM PC and compatibles, Apple II, TI Pro, Kaypro, and Osborne computers are available. The CE-515P sells for $399.

Sharp has also unveiled four monitors: the 12M-15BU, a 12" monochrome (green) screen ($199); the 12M-15BUA, a 12" monochrome (amber) screen ($199); the 12M-22U, a 12" RGB color ($549); and the 13M-31U, a 13" composite color ($399). All monitors display text resolution of 25 lines of 80 characters.

Sharp has also announced three pocket computers. The PC-1260 and PC-1261 feature a two-line LCD screen, 8-bit microprocessor, and built-in mathematics software. The PC-1260 ($129) contains 4.4K RAM, and the PC-1261 ($195) has 10.4K RAM. The PC-1350 offers a four-line LCD screen, 5K RAM, a plug-in 16K RAM card, and



40K ROM with built-in Basic and graphics software. The PC-1350 sells for $195.

Sharp Electronics
10 Sharp Plaza
Paramus, NJ 07652
(201) 265-5600
CIRCLE **427** ON READER SERVICE CARD

Monitors and Plotter from Roland

Roland has unveiled the CC-121, a 12" RGB color monitor with text resolution of 25 lines of 80 characters and graphics resolution of 640 x 200 pixels. The CC-121 has two modes, one for the IBM PC and one for the Apple II series. It retails for $599.

Roland has also released the MB-142, a 14" monochrome monitor with text resolution of 25 lines of 80 characters and graphics resolution 720 x 350 pixels. It has two display modes: a regular white text on black screen and an inverse black text on white screen. The price of the MB-142 has not been set.

Roland has also unveiled the DXY-880 color plotter. It contains 40 built-in GL commands compatible with Hewlett-Packard and *Lotus 1-2-3* formats. It has a 3K buffer expandable to 10K, a built-in digitizer for scaling images up and down, and a plot speed of 200mm per second in all directions. It accepts 8.5" x 11" and 11" x 17" paper, and international character fonts are available. The DXY-880 sells for $1295.

Roland DG
7200 Dominion Circle
Los Angeles, CA 90040
(213) 685-5141
CIRCLE **428** ON READER SERVICE CARD

Composite Color Monitor

Sakata has announced the SC-100, a 13" composite color monitor compatible with the IBM PC, Apple II, Atari 800, Commodore 64, and other computers. It produces a minimum of eight colors and has a text resolution of 25 lines of 40 characters. The SC-100 retails for $329.

Sakata
651 Bonnie Ln.
Elk Grove Village, IL 60007
(312) 593-3211
(800) 323-6647
CIRCLE **429** ON READER SERVICE CARD

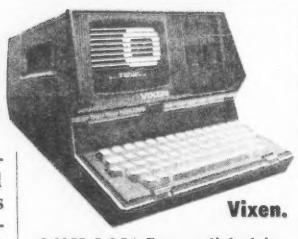
Half-Height Drives

Microsci has introduced the A.5 and A.5c, half-height, 143K, 5.25" floppy disk drives for the Apple IIe and IIc respectively. Both use a direct drive motor instead of a drive belt. The A.5 sells for $269; the A.5c for $299.

Microsci
2158 S. Hathaway St.
Santa Ana, CA 92705
(714) 241-5600
CIRCLE **430** ON READER SERVICE CARD

The Resurrection of Osborne

Osborne Computer, reorganized under Chapter 11 bankruptcy protection, has released the Osborne 3 Encore, a 10-pound notebook computer. It features a 16-bit 80C86 microprocessor, 128K RAM expandable to 512K, a

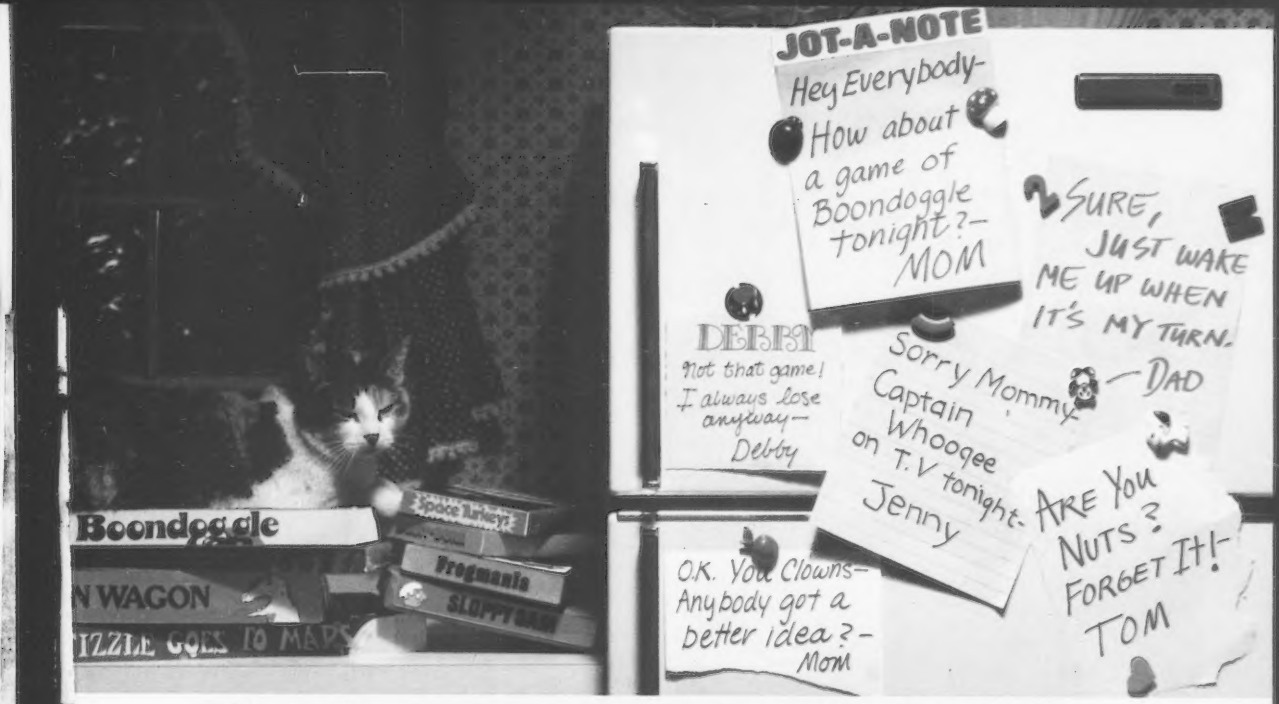


Vixen.

360K 5.25" floppy disk drive with room for a second drive, an internal 300 baud modem, and a 73-key keyboard. The LCD screen has a text resolution of 16 lines of 80 characters and a graphics resolution of 480 x 128 pixels. The Encore carries a suggested retail price of $2195.

Osborne has also introduced the Osborne 4 Vixen, a 22-pound portable computer. It contains a Z80A microprocessor, 64K RAM, a built-in 7" amber display, graphics board, two 390K, 5.25" floppy disk drives, an RS-232C serial port, and a Centronics parallel port. The Vixen comes bundled with CP/M 2.2, *WordStar*, *SuperCalc* 2, Mbasic, *Media Master*, and a game called *Desolation*. It carries a suggested retail price of $1298.

Osborne Computer
42680 Christy St.
Fremont, CA 94538
(415) 887-8080
CIRCLE **431** ON READER SERVICE CARD


JOT-A-NOTE
Hey Everybody- How about a game of Boondoggle tonight?- MOM
SURE, JUST WAKE ME UP WHEN IT'S MY TURN.
DEBBY
Not that game! I always lose anyway- Debby
Sorry Mommy — DAD
Captain Whoogee on T.V tonight- Jenny
ARE YOU NUTS? FORGET IT! TOM
O.K. You Clowns- Anybody got a better idea?- Mom
Boondoggle
Progmania

If getting the whole family together is a real challenge, maybe you need games that really challenge the whole family.

Introducing a new generation of computer games. Family Learning Games from Spinnaker.

Ever notice how a little fun with the family can be a little hard to arrange?

Well, now there's a solution – Spinnaker's Family Learning Games. A whole family of great games that make getting the family together seem like child's play. And make "family fun" really seem like fun again. What's more, they'll even help your kids develop some very important skills.

What makes our Family Learning Games so special? Well, for one thing they're designed to challenge and excite everyone in the family, from grade schoolers to grownups. Their unique combination of chance and strategy makes them perfect for young players, yet challenging enough that everyone will want to play them again and again.

But what makes our Family Learning Games even more unique is how they help kids learn – about problem solving, strategizing, spelling, even Greek mythology. That's quite a bit more than they'd learn from a typical board game (if you could even get them to play a typical board game).

So next time you want to get everybody together, don't get discouraged – get Spinnaker's Family Learning Games.

You'll find the biggest challenge in family fun won't be on the refrigerator. It'll be on the computer.

Spinnaker games are available for ColecoVision® and for Coleco Adam,™ Commodore 64™ and Atari® home computers.

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AEGEAN VOYAGE.™

Where do monsters lurk? And which islands have treasures to behold? Heed the oracle's words, for only his clues can lead you to riches and a safe return. **Ages 8 - Adult.**

ADVENTURE CREATOR.™

Design a challenging adventure game that everyone can play – or let the computer design one for you. It's exciting, creative – and utterly addictive! **Ages 12 - Adult.**

UP FOR GRABS.™

It's a wildly exciting crossword game where everyone has to think fast. More words will help you win – but don't get caught with leftover letters! **Ages 8 - Adult.**

SPINNAKER™

We make learning fun.

Cartridges for: ColecoVision, Coleco Adam, Atari and Commodore 64.

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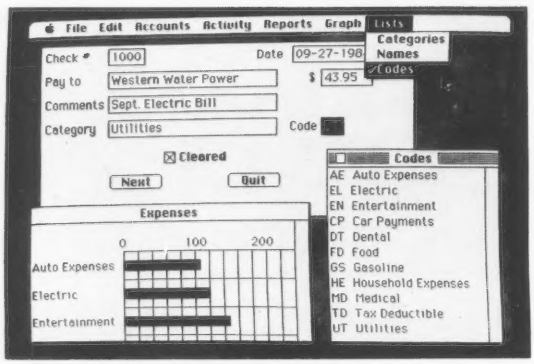
What's New In Software

Russ Lockwood



Microsoft Basic for Macintosh

Microsoft has released version 2.0 of Basic for the Macintosh. Programs created with the new version can access the mouse, pull-down menus, multiple windows, dialog boxes, buttons, sound effects, and music, graphics, and QuickDraw routines for font, text, and cursor support.

Microsoft Basic 2.0 for the Macintosh retails for $150. Owners of version 1.0 can receive an upgrade for a minimal fee.

Microsoft
10700 Northup Way
Box 97200
Bellevue, WA 98009
(206) 828-8080

CIRCLE **437** ON READER SERVICE CARD

Graphics Packages from Baudville

Baudville has introduced two graphics packages, *Blazing Paddles* and *Take 1*, for 48K Apple II series computers.

Blazing Paddles features the ability to mix colors to create over 200 textured hues, paint with a variety of brush strokes, and insert ovals, lines, and rectangles. It includes dot by dot editing, text fonts, pre-dawn shapes, and a printer dump for most dot-matrix printers. *Blazing Paddles* retails for $49.95.

Take 1 allows users to create full color computer animation without the need to purchase Sprite expansion boards. It includes a library of animation shapes and sells for $59.95.

Baudville
1001 Medical Park Dr. SE
Grand Rapids, MI 49506
(616) 957-3036

CIRCLE **438** ON READER SERVICE CARD

DataBase for TI Pro

Texas Instruments has released *PC/Focus*, a relational database management system for the TI Professional and Portable Professional computers. *PC/Focus* is based on the mainframe version of Focus and consists of a database, nonprocedural language, and report writing and data analysis functions.

PC/Focus requires 512K RAM and a Winchester drive. It sells for $1595.

Texas Instruments
Data Systems Group
P.O. Box 809063
Dallas, TX 75380
(800) 527-3500

CIRCLE **435** ON READER SERVICE CARD

Fast Load for Commodore 64

Epyx has introduced *Fast Load*, a plug-in cartridge that enables the Commodore 64 to load programs from disk up to five times faster than normal and copy disks up to 10 times faster than normal. The company claims *Fast Load* works with 95 percent of all software.

Epyx has not set the price, but indicates it will retail for about the same price as a computer game.

Epyx
1043 Kiel Ct.
Sunnyvale, CA 94089
(408) 745-0700

CIRCLE **436** ON READER SERVICE CARD

WordStar 2000 and 2000 Plus

MicroPro has introduced *WordStar 2000*, an advanced version of *WordStar* with text and data merging functions, on-screen windows, on-screen underlining and boldfacing, automatic footnoting, an undo command to restore text, and a built-in spelling checker.

WordStar 2000 Plus adds mailing list database functions, a telecommunications capability for sending documents via electronic mail, and an index and table of contents generator.

Both versions run on the IBM PC and compatibles and require 256K RAM. The IBM PC AT version requires 320K RAM. *WordStar 2000* sells for $495. *WordStar 2000 Plus* retails for $595. Upgrades for current *WordStar* owners cost $250 for *WordStar 2000* and $350 for *WordStar 2000 Plus* and require the exchange of the original program disk.

MicroPro International
33 San Pablo Ave.
San Rafael, CA 94903
(415) 499-1200

CIRCLE **439** ON READER SERVICE CARD

Educational Software
That Works:

Spell.

Spell It!

Spell expertly 1000 of the most misspelled words. Learn the spelling rules. Improve with 4 exciting activities, including a captivating arcade game! Add your own spelling words.

ages 10 — adult / 2 disks: $49.95

Math.

Math Blaster!

Master addition, subtraction, multiplication, division, fractions, decimals and percentages — by solving over 600 problems. Learn your math facts with 4 motivating activities, including a fast-action arcade game! Add your own problems.

ages 6 — 12 / 2 disks: $49.95

Word.

Word Attack!

Add 675 new words to your vocabulary — with precise definitions and sentences demonstrating usage. Build your skills with 4 fun-filled activities, including an arcade game! Add your own words.

ages 8 — adult / 2 disks: $49.95

Read.

Speed Reader II

Increase your reading speed and improve comprehension! Six exercises designed by reading specialists vastly improve your reading skills. Chart your own progress with 35 reading selections and comprehension quizzes. Add your own reading materials.

high school, college & adult / 2 disks: $69.95

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In California call: (213) 373-9473

Davidson & Associates
6069 Groveoak Place #12
Rancho Palos Verdes, CA 90274

CIRCLE 123 ON READER SERVICE CARD

Davidson.

teacher certified NEA

Apple, IBM and Commodore 64 are trademarks respectively of Apple Computers, Inc., International Business Machines Corp., and Commodore Business Machines, Inc.

Infocom Enters Business Market

Infocom, well known for its interactive fiction adventures, has introduced *Cornerstone*, a relational database system for the IBM PC, XT, AT, and compatibles. Designed for the non-programmer, the program essentially uses a menu-driven approach and is backed with extensive on-line help.

Cornerstone includes the ability to alter the database structure without creating a new database from scratch, a built-in calendar, and interactive report writer. It can convert *pfs* and *dBase II* files to *Cornerstone* files and exchange information with *Lotus 1-2-3* and other spreadsheets, *MailMerge*, and word processing programs.

Cornerstone carries a suggested retail price of $495. A Macintosh version is planned.

Infocom
55 Wheeler St.
Cambridge, MA 02138
(617) 492-1031

CIRCLE **440** ON READER SERVICE CARD

Educational Software from Krell

Krell Software has introduced several educational software packages.

LSAT helps prospective law school candidates with reading comprehension, analytic reasoning, problem solving, and writing ability. It includes a vocabulary building section and simulates LSAT questions, format, and difficulty levels. It retails for $349.95 and is available for the IBM PC, Apple II series, and Commodore 64.

TOEFL (Test of English as a Foreign Language) covers listening comprehension, structure, written expression, and reading comprehension. It includes audio cassettes, sells for $169.95, and is available for the IBM PC, Apple II, and Commodore 64.

Study Money provides assistance to students searching for college financial aid. It matches the career goals, background, and training of a student to the sources in its database and offers guidance in writing initial inquiries to the appropriate sources. *Study Money* costs $49.95 and is available for the Apple.

Krell Software
1320 Stony Brook Rd.
Stony Brook, NY 11790
(516) 751-5139

CIRCLE **441** ON READER SERVICE CARD

Disks, Disks, and More Disks

Several manufacturers have introduced blank floppy disks for home and business computers.

Eastman Kodak, the photographic film giant, has entered the disk market with

a complete line of 8", 5.25", and 3.5" floppy disks. The company will package two, five, or 10 disks to the box.

Eastman Kodak
Rochester. NY 14650
(716) 724-4000

CIRCLE **443** ON READER SERVICE CARD

BASF has released a 5.25" high-density floppy disk for use with the 1.2Mb drive in the IBM PC AT. The company is also developing a 3.3Mb 5.25" floppy disk.

BASF Systems
Crosby Dr.
Bedford, MA 01730
(617) 271-4000

CIRCLE **444** ON READER SERVICE CARD

Maxell has also introduced a 5.25", high-density floppy disk for the 1.2Mb drive in the IBM PC AT. Maxell will be supplying its high-density disks for packaging under the Kodak label.

Maxell
60 Oxford Dr.
Moonachie, NJ 07074
(201) 440-8020

CIRCLE **446** ON READER SERVICE CARD

Infomatics General has announced a line of 5.25" floppy disks for the IBM PC and XT.

Infomatics General
P.O. Box 723537
Atlanta, GA 30339
(800) 241-3306 or
(800) 282-4170 or
(404) 432-1996

CIRCLE **447** ON READER SERVICE CARD

TDK has introduced a 5.25" floppy disk for use with the 1.2Mb drive in the IBM PC AT. The company has also expanded its 3.5" floppy disk line to include both single-and double-density versions and single- and double-sided versions.

TDK Electronics
12 Harbor Park Dr.
Port Washington, NY 11050
(516) 625-0100

CIRCLE **442** ON READER SERVICE CARD

Sentinel Technologies has introduced colored 5.25" and 8" floppy disks. Colors available are medium blue, light blue, green, yellow, orange,

red, magenta, maroon, brown, and gray. The disks are packaged one of each color to the box of 10 of the same color to the box.

Sentinel Technologies
One Sentinel Plaza
Hyannis, MA 02601
(617) 775-5220

CIRCLE **445** ON READER SERVICE CARD

Dennison Manufacturing, maker of Elephant brand floppy disks, has announced the Elephant Premium Floppy Disk, a line of 5.25" and 3.5" disks designed for business use.

Dennison Computer Supplies
82 Calvary St.
Waltham, MA 02254
(617) 899-0012

CIRCLE **448** ON READER SERVICE CARD

You never know who you will meet or what will be said when you're on American People/Link.

AMERICAN PEOPLE/LINK™ users meet a lot of different people. That's because PEOPLE/LINK — the nation's first all entertainment videotex network — allows anyone with a word processor, personal computer or terminal, and a modem to communicate with other users throughout the country from the privacy of their own homes.

Sometimes these electronic conversations are serious...sometimes they're outrageous...but they will always keep your interest as you talk to friends and make new ones. PEOPLE/LINK's recreational programs include:

PARTYLINE — Meet people and talk live with other PEOPLE/LINK members throughout the country in groups or privately.

CLUB-LINK — Join or start a club or group devoted to a favorite hobby, rock group, lifestyle, etc.

WHO-IS-WHO — locate other users with similar interests.

And there's much more with programs like NETMAIL, our person-to-person electronic mail, PEOPLESCAN, the national bulletin board system, and play games such as poker, blackjack, checkers, chess, backgammon, and bridge (color graphics are available for most popular computers).

And the greatest thing is that you don't have to be a computer whiz or even know how to type to use PEOPLE/LINK...just be smart enough to subscribe now!

Talk live nationwide for $2.95/hour . . . an exciting and inexpensive way to meet new friends.*

AMERICAN PEOPLE LINK

Use your Visa, Mastercard, or American Express.
Be On-Line Today! Call Us Toll Free: **1-800-524-0100**

Illinois Residents Call: **1-312-870-5200**

American PEOPLE/LINK
Arlington Ridge Office Center
3215 N. Frontage Road—Suite 1505
Arlington Heights, IL 60004

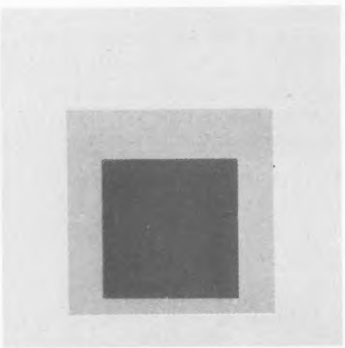
*Subject to change

CIRCLE 101 ON READER SERVICE CARD

A short program to simulate the work of an abstract colorist

Art à la Albers

Michael Crichton



The characteristic image of artist Josef Albers was three overlapping squares, usually drawn in close or contrasting colors. The image is easy to recreate on a computer, but the appropriate interplay of color in the squares is not.

However, the text mode of the IBM PC does allow for subtle color contrasts. The short program in Listing 1 provides many beautiful combinations. There are two things to bear in mind while keying it in: first, lines such as 80 are created by holding down the Alt key while typing the number 176 on the numeric keypad—that is, pressing the End key, the Home key, and the right cursor key. And second, if while debugging you lose your text entirely, you can always get it back by typing COLOR 7,8 in direct mode.

If you wish Albers to turn over in his grave, make these changes:

```
40 FOR D=1 TO 7 : FOR A=14 TO 25
290 COLOR C , C-13 :
    FOR Y=11 TO 17
```

This will cause some of the images to flash.

A more appropriate change involves repeating the instruction lines that draw the three squares, but with different graphics characters, after line 320. There are many ways to do this. It's fun to experiment. ■

Listing 1. Albers program for IBM PC.

```
10 REM ALBERS IBM
20 REM by MC
30 COLOR 7,8:KEY OFF:CLS:WIDTH 40
40 FOR D=1 TO 7:FOR A=1 TO 14
50 B=A:C=B
60 '=======first square======
70 COLOR A,D-1:FOR Y=1 TO 4
80 LOCATE Y,9:PRINT "                          " '26 spaces of alt-176
90 NEXT
100 FOR Y=5 TO 19
110 LOCATE Y,9:PRINT "  "'3 x alt-176
120 LOCATE Y,32:PRINT"  "'3 x alt-176
130 NEXT
140 LOCATE 20,9:FOR X=1 TO 26:PRINT" ";:NEXT'alt-176
150 N=1:GOSUB 350 'delay
160 '======next square======
170 COLOR B,D: FOR Y=5 TO 10
180 LOCATE Y,12:PRINT"                    "  '20 spaces of alt-177
190 NEXT
200 FOR Y=11 TO 17
210 LOCATE Y,12:PRINT"     "'5 x alt-177
220 LOCATE Y,27:PRINT"     "'5 x alt-177
230 NEXT
240 FOR Y=18 TO 19
250 LOCATE Y,12:FOR X=1 TO 20:PRINT" ";:NEXT '177
260 NEXT
270 N=2:GOSUB 350
280 '======third square=====
290 COLOR C,C:FOR Y=11 TO 17
300 LOCATE Y,17:PRINT"          "'10 x alt-219
310 NEXT
320 N=5:GOSUB 350
330 NEXT A,D
340 COLOR 7,8:LOCATE 25,1:PRINT"the end":END
350 FOR CY=1 TO N:FOR DL=1 TO 250:NEXT:NEXT:RETURN
```

Listing 2. Albers program for Apple.

```
10  REM  ALBERS (APPLE)
20  REM
30  HOME : VTAB 22
40  DIM C(120):N = 120
50  FOR V = 1 TO N: READ C(V): NEXT V:V = 0: GR
60  FOR CY = 1 TO N / 3
70  REM  DRAW FIRST SQUARE
80 V = V + 1: COLOR= C(V): GOSUB 160
90  REM  SECOND SQUARE
100 V = V + 1: COLOR= C(V): GOSUB 210
110  REM  THIRD SQUARE
120 V = V + 1: COLOR= C(V): GOSUB 260
130  FOR DL = 1 TO 1000: NEXT
140  NEXT CY
150  PRINT "THE END": END
160  REM  DRAW LARGE SQUARE
170  FOR Y = 0 TO 6: HLIN 5,34 AT Y: NEXT Y
180  FOR Y = 7 TO 37: HLIN 5,7 AT Y: HLIN 32,34 AT Y: NEXT Y
190  FOR Y = 38 TO 39: HLIN 5,34 AT Y: NEXT Y
200  RETURN
210  REM  SECOND SQUARE
220  FOR Y = 7 TO 18: HLIN 8,31 AT Y: NEXT Y
230  FOR Y = 19 TO 33: HLIN 8,13 AT Y: HLIN 27,31 AT Y: NEXT Y
240  FOR Y = 34 TO 37: HLIN 8,31 AT Y: NEXT Y
250  RETURN
260  REM  LAST SQUARE
270  FOR Y = 19 TO 33: HLIN 14,26 AT Y: FOR DL = 1 TO 12: NEXT : NEXT
280  RETURN
290  REM  DATA STATEMENTS
300  DATA 10,5,10, 5,10,0,5,10,5,5,10,1,5,9,1,1,9,5,1,9,10,9,1,10
310  DATA  9,1,4,9,12,4,10,12,4,12,10,4,5,10,4,5,10,2,7,10,2,6,10,2,7,
     6,2,9,6,2,1,6,2,1,2,6,6,2,6,6,2,0
320  DATA  4,12,1,14,4,12,2,6,2,2,6,3,4,10,5,9,1,4,4,12,0,10,5,10,9,1,
     10,1,3,2
330  DATA   4,12,1,2,6,10,14,4,0,1,9,0,4,10,5,1,9,10,1,5,10,10,5,10
```

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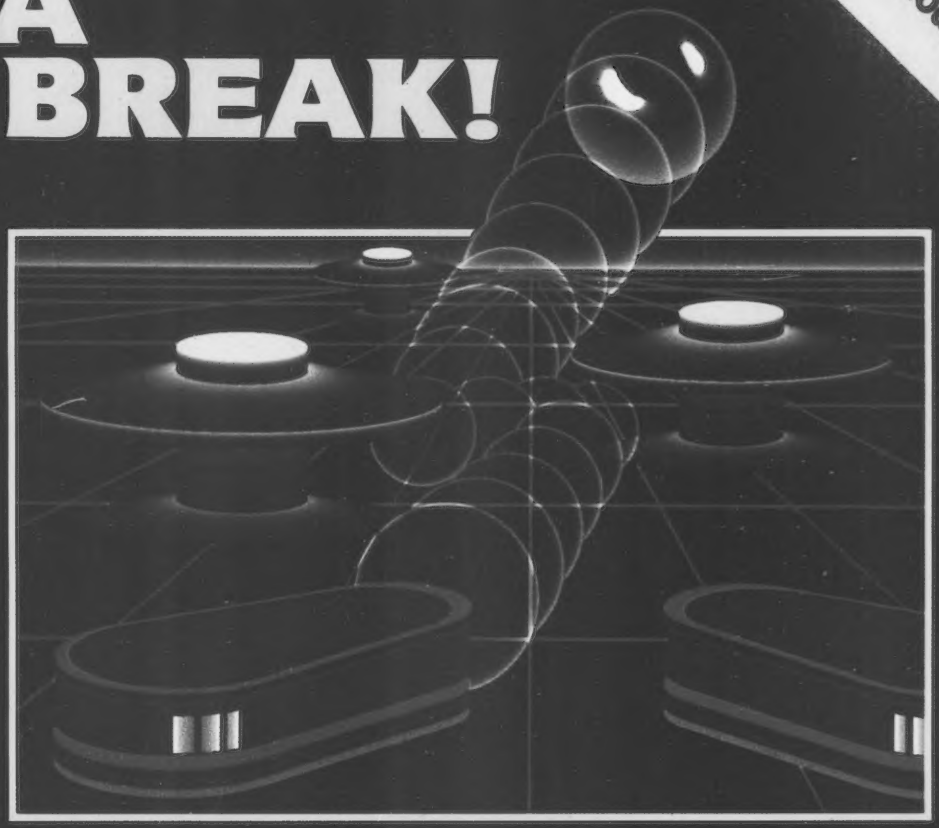

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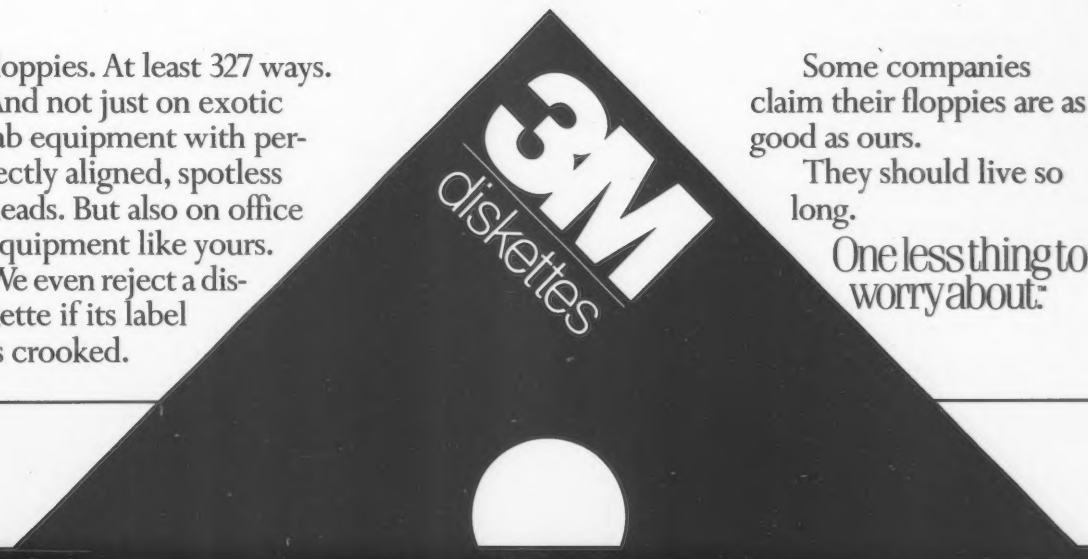

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Extended hi-res graphics on the Apple

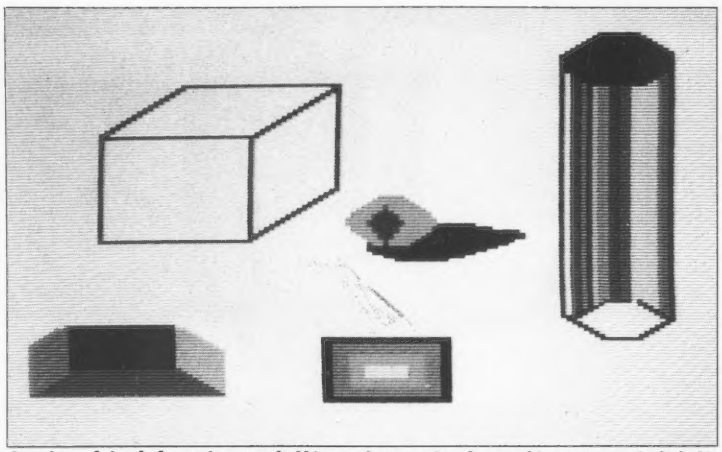
Sixteen Colors And Beyond

David Lubar

Until now, anyone doing high-resolution graphics on the Apple has faced some frustrating limitations. While six colors are available, certain colors cannot appear next to one another within the same byte. As a result of this, we have all dealt with the choice of limiting object movement and location, limiting background colors, or ignoring the changes and hoping no one will notice.

Well, such problems are now history. If you own an Apple IIc or IIe with extended 80-column card, you have at your fingertips the ability to produce extended hi-res graphics with 16 independent colors.

The following article shows how this extended mode works and how to use it from Basic or assembly language. The concepts covered assume some familiarity with binary and hex numbers and a passing aquaintance with standard hi-res on the Apple. Sample programs are included for those who want to get the results but don't care about the details. So, if you couldn't care less about bits, pixels, and other hacker delights, just skip the bulk of this article and go to the section on using the sample programs. For the rest of us, it's on to the gory details. But first, a word of inspiration.



A variety of simple forms in extended hi-res, drawn using the graphics programs included in this article. This sample was photographed from the screen of an AppleColor Monitor 100.

Why Bother

Extended hi-res follows in the graphic tradition established by the Apple II, requiring a fairly complex amount of bit fiddling to get results. While the Apple has built-in routines for normal hi-res, to work with the new mode you must start from scratch. Is it worth the effort?

As mentioned above, this mode has no color conflicts. Also, color can be thought of as a form of resolution. Given two systems with the same number of pixels, the one with more colors is capable of displaying greater detail. Objects can have shadings and highlights, and features can be marked with contrasting colors. The background possibilities produced by dithering (blending patterns of colors to produce a new shade) increase as the color palette expands.

This whimsical landscape is an example of the color potential of Apple extended hi-res.

Beyond all this, there is one compelling reason to use extended hi-res. As the mountain climbers say, "It's there." Part of the fun of owning a computer is pushing the machine to its limit, making it do as much as possible. Who knows what neat things will result.

Standard hi-res graphics on the Apple uses 40 bytes per line, with seven bits out of each byte controlling pixels. This gives a potential resolution of 280 pixels. However, the color of a pixel is determined in part by whether a bit is at an odd or an even coordinate. This cuts the actual resolution for color graphics down to 140 pixels per line.

Extended hi-res uses 80 bytes per line, thus offering a potential of 560 plotting locations. As in the standard mode, this resolution comes without any color control. To get 16 colors, you need four bits per pixel (a pattern of four bits has 16 possible values from 0000 to 1111). Normally, a mode using four bits would be ideal since that would work out as two

pixels per byte.

The problem here is that extended hi-res maintains the beastly tradition of ignoring the hi bit. Only seven bits out of each byte are used for graphics data. We pause here for a collective sigh.

Shifty Little Devils

As a result of losing the hi bit, the data for some pixels are spread between two bytes. So, the first problem with which we must deal is setting the right bits in the proper bytes to light the desired pixel. For example, a blue pixel has a pattern of 0001 and a white pixel is 1111. The hex value used to store these colors in the first pixel of a line would be $01 for blue and $0F for white. (Note that, as in standard hi-res, the lowest bit plots the leftmost position.)

When you move to the next pixel, the bit pattern is shifted four positions. Since the hi bit of the byte is unused, one bit must move to the next byte. Thus, blue in the second position would be $10, $00, and white would be $70, $01. See Figure 1 for an example of this.

With four bits per pixel and seven bits available from each byte, it take four bytes to plot the first seven pixels. Then the pattern repeats. So, each color can be represented by seven different values, depending on the coordinate of the pixel being plotted, and some of these values are spread between two bytes.

While this seems quite bizarre, it is not really that much different from standard hi-res, where each has seven different byte values for each pair of pixels.

The next problem is knowing which byte to change. The 80 bytes of each display line are taken alternately from main memory and the auxiliary memory on the 80-column card. The first byte of each line comes from auxiliary memory. So, to plot a pixel we need to know which bit pattern to use, which byte or bytes to change, and whether each byte is in main or auxiliary memory. This is a time-consuming task. Fortunately, there are few tricks that simplify the work.

In my first grapplings with this mode, I tried to figure out what was happening by putting the problem on paper. This produced some fearful symmetry, or at least a clue to what was going on. Take a look at Figure 2. It shows the first four bytes of the extended hi-res screen, breaking the data into groups of four bits and showing the memory bank that produced each byte.

There are three features of interest. First, each pixel is either part of one byte or spread between two bytes. Second, the starting byte of each pixel comes either from main or auxiliary memory. Finally, each pixel starts in either an odd or even byte. All this has to be determined before plotting a pixel.

Some bit diddling produces a few useful patterns. Taking just the first seven pixels for now, note that all pixels that require just one byte occur at even coordinates (0, 2, 4, 6).

Next, look at the pixels that start in auxiliary memory. These occur at coordinates 0, 1, 4, and 5. There is a common thread here. Each of these values, in binary, has a zero in the second bit. So, by checking the first two bits of a coordinate, we can tell whether to start in main or auxiliary memory, and whether one or two bytes must be accessed. If the lo bit of the coordinate is on, the number is odd and we start in main memory. If the next bit is on, we need to deal with two bytes.

One last glance at the illustration shows that if the coordinate is greater than three, the plotting starts on an odd byte. All of this works for the first seven pixel coordinates. Then the pattern repeats. Before plotting, we need to know the remainder when the coordinate is divided by seven. Math types call this MOD7. I call it a nuisance.

The final bit of information needed is the starting byte of the desired horizontal screen line. The Apple screen is not mapped in linear order (time for another large collective sigh). The standard way to get the location is with a look-up table.

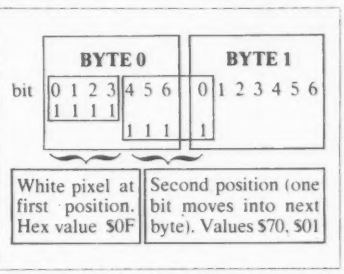

BYTE 0
BYTE 1
bit
0 1 2 3 4 5 6
0 1 2 3 4 5 6
1 1 1 1
1 1 1
1
White pixel at first position. Hex value $0F
Second position (one bit moves into next byte). Values $70, $01

Figure 1. As pixel is moved it can be spread between bytes.

The address can also be calculated, but this is time-consuming. If you are not familiar with screen look-up tables, check your back issues, or look at the way Listing 1 finds the screen address. Once you have the start of the line, you can find the address of the block of four bytes using the formula BYTE = START + INT (XLOC/7)*2, where XLOC is the horizontal coordinate.

OK, we have all the information required to plot a pixel. To get something on the screen, two separate actions are required. First, we must deal with all the stuff discussed above. As if that weren't enough, we also have to handle the bank switching needed to store in main or auxiliary memory. Before getting into the actual plotting, let's look at the various switches used in extended hi-res.

Switch Hitters

If you have a IIe with extended 80-column card,you must have the jumper installed. First, check the serial number on your Apple main board. If it begins with an A, you are out of luck. Extended hi-res works only on Apples of revision B or later.

Next, annunciator number 3 must be strobed at location $CO5E. Hi-res itself is set up in the normal fashion by turning on graphics at $C050 and enabling hi-res at $CO57. The choice of full screen ($CO52) or mixed graphics and text ($CO53) is still available, though you should do a PR#3 when using mixed mode. Otherwise, the Apple will be in 80-column mode while trying to display text in 40-column mode. This is fine if you like a space between each pair of letters, but it doesn't produce a very nice display.

Now that the graphics switches

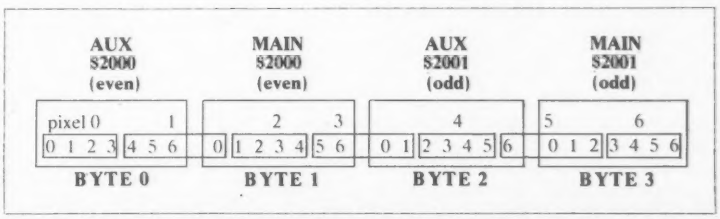


Figure 2. First four bytes provide seven pixels. Pixels 0, 2, 4, 6 require only one byte. Pixels 0, 1, 4, 5 start in Auxiliary memory. Pixels 0, 1, 2, 3 start at an even byte. This pattern repeats for each group of four bytes. Note that, though four bytes are used, the group uses only two memory locations.

have been set, there are just two more switches needed to set things up. Writing to $COOD enables the 80-column mode. Writing into $COO1 sets up the Apple so bytes can be stored into either main or auxiliary memory. The two switches normally used for controlling the page display are now used to select memory banks. The page 1 switch ($CO54) enables main memory. The page 2 switch ($CO55) enables auxiliary memory. Only memory in the hi-res screen ($2000-$3FFF or 8192 to 16383 decimal) is controlled by these switches.

When setting up a pattern, you must not change other bits in the byte, or you will change the neighboring pixel. This is not a color conflict as in standard hi-res, since any two colors can be next to each other.

If you haven't encountered soft switches before, don't let the above barrage of numbers get you down. Switches are just memory locations that turn things on and off. Some are activated with any type of access (either a PEEK or a POKE from Basic or any operation referencing memory from assembly language). Some must be written to (POKE or any assembly language store command) while others must be read (PEEK or any load command).

The extended 80-column card manual covers these switches in great detail. The values given here are in hex. To access the switches from Basic, you must convert these values to decimal. See Listing 4 for an example of this.

Once you have enabled extended hi-res, you can place values into screen memory and see exactly how the mode works. Try putting values from 1 to 16 into location $2000 (if your monitor doesn't display the top line, drop down a bit to $2100). You'll find that pixels of different colors occupy slightly different positions (this is the 560 resolution), but no colors repeat within any position.

Actually, four of the colors are made up of a single set bit (values 1, 2, 4, and 8). These are the purest colors. Pixel patterns using more bits get brighter,

Listing 1.

```
                        1    * SUBROUTINE TO INITIALIZE
                        2    * EXTENDED HI-RES AND PLOT
                        3    * A PIXEL AT A GIVEN COORDINATE
                        4    *
                        5    * SOFT SWITCHES
                        6    *
                        7    TXTON    =    $C051       ;TEXT MODE
                        8    GRON     =    $C050       ;GRAPHICS MODE
                        9    FULLG    =    $C052       ;FULL SCREEN GRAPHICS
                       10    PG1      =    $C054       ;GRAPHICS PAGE 1
                       11    PG2      =    $C055       ;PAGE 2
                       12    HIRES    =    $C057       ;TURN ON HIRES
                       13    ON80     =    $C00D       ;ENABLE 80 COLUMN DISPLAY
                       14    STAUX    =    $C001       ;STORE TO AUX
                       15    AN3      =    $C05E       ;ANNUNCIATOR #3
                       16    *
                       17    * VARIABLES
                       18    *
                       19    PLO      =    $F8         ;GENERAL PURPOSE POINTER
                       20    PHI      =    $F9
                       21    T0       =    $FA         ;GENERAL PURPOSE VARIABLE
                       22    T1       =    $FB
                       23    *
                       24    XLOC     =    $FC         ; X COORDINATE
                       25    YLOC     =    $FD         ; Y COORDINATE
                       26    COLR     =    $FE         ;COLOR VALUE
                       27    BYTE     =    $FF         ;SCREEN BYTE
                       28    *
8000: 4C 06 80         29              JMP  ERASE       ;ENTRY POINT FOR SETUP
8003: 4C 38 80         30              JMP  PLOT        ;ENTRY POINT FOR PLOT
                       31    *
                       32    * ROUTINE FOR ENABLING HI-RES AND
                       33    * CLEARING THE SCREEN
                       34    *
                       35    ERASE
8006: 8D 5E C0         36              STA  AN3         ;SET ANNUNCIATOR #3
8009: 8D 0D C0         37              STA  ON80        ;TURN ON 80 COLUMN MODE
800C: 8D 50 C0         38              STA  GRON        ;TURN ON GRAPHICS MODE
800F: 8D 57 C0         39              STA  HIRES       ;TURN ON HI-RES MODE
8012: 8D 01 C0         40              STA  STAUX       ;SET UP TO STORE IN AUX MEMORY
8015: 8D 54 C0         41              STA  PG1         ;BANK SELECT MAIN GRAPHICS MEM
                       42    *
                       43    *
                       44    * SET UP POINTER TO HI-RES MEMORY
                       45    *
8018: A9 20            46              LDA  #$20        ;POINT TO LOCATION $2000
801A: 85 F9            47              STA  PHI
801C: AA               48              TAX              ;DO $20 PAGES
801D: A9 00            49              LDA  #$00
801F: A8               50              TAY
8020: 85 F8            51              STA  PLO
                       52    *
                       53    LP1
8022: 8D 54 C0         54              STA  PG1         ;ENABLE MAIN MEMORY
8025: 91 F8            55              STA  (PLO),Y     ;CLEAR A BYTE
8027: 8D 55 C0         56              STA  PG2         ;ENABLE AUX MEMORY
802A: 91 F8            57              STA  (PLO),Y
802C: C8               58              INY              ;NEXT BYTE
802D: D0 F3            59              BNE  LP1
802F: E6 F9            60              INC  PHI         ;NEXT PAGE
8031: CA               61              DEX              ;DONE?
8032: D0 EE            62              BNE  LP1         ;NO, BACK FOR MORE
8034: 8D 54 C0         63              STA  PG1         ;LEAVE WITH MAIN MEMORY ENABLED
8037: 60               64              RTS              ;ALL DONE
                       65    *
                       66    * PLOTTING ROUTINE
                       67    * PASS X COORDINATE IN $FC
                       68    * Y CORODINATE IN $FD
                       69    * COLOR IN $FE
                       70    *
                       71    PLOT
8038: A6 FD            72              LDX  YLOC        ;GET ADDRESS OF
803A: BD C5 80         73              LDA  TABLO,X     ;FIRST BYTE OF LINE
803D: 85 F8            74              STA  PLO
803F: BD 85 81         75              LDA  TABHI,X
8042: 85 F9            76              STA  PHI
                       77    *
8044: A5 FC            78              LDA  XLOC        ;DIVIDE X COORDINATE
8046: A2 00            79              LDX  #$00        ;BY 7
8048: C9 07            80    MOD7      CMP  #$07
804A: 90 06            81              BLT  MODDUN
804C: 38               82              SEC
804D: E9 07            83              SBC  #$07
804F: E8               84              INX
8050: D0 F6            85              BNE  MOD7
```

```
                    86   MODDUN
8052: B5 FA         87          STA  T0          ;SAVE REMAINDER
8054: 8A            88          TXA             ;MULTIPLY RESULT BY 2
8055: 0A            89          ASL             ; TO GET DESIRED BYTE IN LINE
8056: 85 FF         90          STA  BYTE
                    91   *
8058: A2 00         92          LDX  #$00       ;START IN MAIN OR AUX?
805A: A5 FA         93          LDA  T0         ; IF BIT 2=0
805C: 29 02         94          AND  #$02       ;THEN START IN AUX
805E: D0 01         95          BNE  INMAIN     ;ELSE START IN MAIN
8060: E8            96          INX
                    97   INMAIN
8061: 9D 54 C0      98          STA  PG1,X      ;ENABLE PROPER BANK
                    99   *
8064: A5 FA        100          LDA  T0         ;IF IN PIXEL 4,5 OR 6
8066: C9 04        101          CMP  #$04       ;THEN MUST MOVE OVER 1 BYTE
8068: 90 02        102          BLT  EVEN
806A: E6 FF        103          INC  BYTE
                   104   EVEN
806C: A5 FE        105          LDA  COLR       ;GET COLOR
806E: 85 FB        106          STA  T1         ;SAVE IT
8070: A6 FA        107          LDX  T0         ;GET PIXEL POSITION
8072: BD 45 82     108          LDA  SHFT1,X    ;AND NUMBER OF SHIFTS
8075: F0 06        109          BEQ  SH1DUN     ;NO SHIFTS
8077: AA           110          TAX
8078: 06 FB        111   SHLP1  ASL  T1         ;SHIFT THE REQUIRED AMOUNT
807A: CA           112          DEX
807B: D0 FB        113          BNE  SHLP1
                   114   SH1DUN
807D: A6 FA        115          LDX  T0         ;GET PIXEL POSITION
807F: A4 FF        116          LDY  BYTE       ;INDEX INTO SCREEN
8081: B1 F8        117          LDA  (PLO),Y    ;GET CURRENT SCREEN BYTE
8083: 3D 53 82     118          AND  MSK1,X     ;STRIP OUT DESIRED BITS
8086: 85 FB        119          ORA  T1         ;PUT IN NEW VALUE
8088: 91 F8        120          STA  (PLO),Y    ;STORE TO SCREEN
                   121   *
808A: A5 FA        122          LDA  T0         ;IS PIXEL SPLIT BETWEEN BYTES?
808C: 4A           123          LSR
808D: 90 32        124          BCC  PLOTOUT    ;NO, ALL DONE
                   125   *
808F: A5 FA        126          LDA  T0         ;YES, REPEAT FOR SECOND BYTE
8091: C9 03        127          CMP  #$03       ;CHANGING TO ODD BYTE?
8093: D0 02        128          BNE  BYTEOK     ;NO
8095: E6 FF        129          INC  BYTE       ;YES, INCREASE INDEX
                   130   BYTEOK
8097: A2 00        131          LDX  #$00
8099: A5 FA        132          LDA  T0
809B: 29 02        133          AND  #$02
809D: F0 01        134          BEQ  INAUX1     ;SET UP PROPER BANK
809F: E8           135          INX
                   136   INAUX1
80A0: 9D 54 C0     137          STA  PG1,X
80A3: A5 FE        138          LDA  COLR
80A5: 85 FB        139          STA  T1
80A7: A6 FA        140          LDX  T0
80A9: BD 4C 82     141          LDA  SHFT2,X    ;GET SHIFT VALUE FOR 2ND BYTE
80AC: F0 06        142          BEQ  SH2DUN
80AE: AA           143          TAX
80AF: 46 FB        144   SH2LP  LSR  T1
80B1: CA           145          DEX
80B2: D0 FB        146          BNE  SH2LP
                   147   SH2DUN
80B4: A6 FA        148          LDX  T0
80B6: A4 FF        149          LDY  BYTE
80B8: B1 F8        150          LDA  (PLO),Y
80BA: 3D 5A 82     151          AND  MSK2,X
80BD: 05 FB        152          ORA  T1
80BF: 91 F8        153          STA  (PLO),Y
                   154   PLOTOUT
80C1: BD 54 C0     155          STA  PG1        ;MAKE SURE MAIN BANK IS ON
                   156   *
80C4: 60           157          RTS             ;ALL DONE
                   158   *
                   159   * LOOK-UP TABLES FOR SCREEN ADDRESSES
                   160   *
                   161   TABLO
80C5: 00 80 00     162          HEX  0000000000000000
80C8: 00 00 00 00 00
80CD: 80 80 80     163          HEX  8080808080808080
80D0: 80 80 80 80 80
80D5: 00 80 00     164          HEX  0000000000000000
80D8: 00 00 00 00 00
80DD: 80 80 80     165          HEX  8080808080805080
80E0: 80 80 80 80 80
80E5: 00 00 00     166          HEX  0000000000000000
80E8: 00 00 00 00 00
```

(Listing 1 continued on page 134)

tending toward the pastel. Also, when setting up a pattern, you must be careful not to change other bits in the byte, or you will change the neighboring pixel. This is not a color conflict as in standard hi-res, since any two colors can be next to each other. It's just another messy detail. The best way to get the hang of all of this is to experiment, which brings us to the sample programs.

Using the Programs

Listing 1 is an assembly language program that does all the dirty work. It has two entry points. The first, at $8000, goes to a routine that initializes extended hi-res and clears the screen. It can be accessed with a JSR $8000 from assembly language or a CALL 32768 from Basic. The second routine, accessed with JSR $8003 or CALL 32771, is the plotting (or plodding) code. It requires three parameters: the X coordinate (from 0-139), the Y coordinate (from 0-191 for full screen graphics or 0-159 for mixed mode), and the desired color (from 0-15).

If the color value is greater than 15, the hi nibble is ignored. If the X or Y coordinate is out of range, bad things will happen. From Basic, POKE the X value at 252, the Y value at 253, and the color at 254. In assembly language, use $FC, $FD, and $FE.

For those interested in the exact workings of the plotting program, the comments in the listing give all the details. True bit hackers will probably notice that the routine can be sped up in various ways. Instead of using the divide-by-seven loop, a MOD7 table can be added. Also, instead of shifting the color nibble, a set of seven tables can be added, giving the actual bit pattern for each location.

Listings 2 and 3 are Basic programs that use the plotting routine. The first draws nested squares using all the hi-res colors. While not very useful in itself, it does show what the Apple is capable of and offers an example of how to access the plotting routine. Listing 3 is a simple drawing program. Finally, Listing 4 shows how to enable extended hi-res and clear the screen entirely from Basic. It can be used as a set-up routine for experimentation.

If you plan to do any disk access, make sure to turn on the 80-column card with PRINT ctrl-D;"PR#3" rather than just PR#3, or DOS will become unhooked.

Well, that about covers it. Have fun with the programs. ■

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Listing 1. *(continued)*

```
88ED: 80 80 80  167             HEX  8080808080808080
88F0: 80 80 80 80 80
88F5: 80 80 80  168             HEX  8080808080808080
88F8: 80 80 80 80 80
88FD: 80 80 80  169             HEX  8080808080808080
8100: 80 80 80 80 80
8105: 28 28 28  170             HEX  2828282828282828
8108: 28 28 28 28 28
810D: A8 A8 A8  171             HEX  A8A8A8A8A8A8A8A8
8110: A8 A8 A8 A8 A8
8115: 28 28 28  172             HEX  2828282828282828
8118: 28 28 28 28 28
811D: A8 A8 A8  173             HEX  A8A8A8A8A8A8A8A8
8120: A8 A8 A8 A8 A8
8125: 28 28 28  174             HEX  2828282828282828
8128: 28 28 28 28 28
812D: A8 A8 A8  175             HEX  A8A8A8A8A8A8A8A8
8130: A8 A8 A8 A8 A8
8135: 28 28 28  176             HEX  2828282828282828
8138: 28 28 28 28 28
813D: A8 A8 A8  177             HEX  A8A8A8A8A8A8A8A8
8140: A8 A8 A8 A8 A8
8145: 50 50 50  178             HEX  5050505050505050
8148: 50 50 50 50 50
814D: D0 D0 D0  179             HEX  D0D0D0D0D0D0D0D0
8150: D0 D0 D0 D0 D0
8155: 50 50 50  180             HEX  5050505050505050
8158: 50 50 50 50 50
815D: D0 D0 D0  181             HEX  D0D0D0D0D0D0D0D0
8160: D0 D0 D0 D0 D0
8165: 50 50 50  182             HEX  5050505050505050
8168: 50 50 50 50 50
816D: D0 D0 D0  183             HEX  D0D0D0D0D0D0D0D0
8170: D0 D0 D0 D0 D0
8175: 50 50 50  184             HEX  5050505050505050
8178: 50 50 50 50 50
817D: D0 D0 D0  185             HEX  D0D0D0D0D0D0D0D0
8180: D0 D0 D0 D0 D0
                186  *
                187  TABHI
8185: 20 24 28  188             HEX  2024282C3034383C
8188: 2C 30 34 38 3C
818D: 20 24 28  189             HEX  2024282C3034383C
8190: 2C 30 34 38 3C
8195: 21 25 29  190             HEX  2125292D31353939
8198: 2D 31 35 39 3D
819D: 21 25 29  191             HEX  2125292D31353939
81A0: 2D 31 35 39 3D
81A5: 22 26 2A  192             HEX  22262A2E32363A3E
81A8: 2E 32 36 3A 3E
81AD: 22 26 2A  193             HEX  22262A2E32363A3E
81B0: 2E 32 36 3A 3E
81B5: 23 27 2B  194             HEX  23272B2F33373B3F
81B8: 2F 33 37 3B 3F
81BD: 23 27 2B  195             HEX  23272B2F33373B3F
81C0: 2F 33 37 3B 3F
81C5: 20 24 28  196             HEX  2024282C3034383C
81C8: 2C 30 34 38 3C
81CD: 20 24 28  197             HEX  2024282C3034383C
81D0: 2C 30 34 38 3C
81D5: 21 25 29  198             HEX  2125292D31353939
81D8: 2D 31 35 39 3D
81DD: 21 25 29  199             HEX  2125292D31353939
81E0: 2D 31 35 39 3D
81E5: 22 26 2A  200             HEX  22262A2E32363A3E
81E8: 2E 32 36 3A 3E
81ED: 22 26 2A  201             HEX  22262A2E32363A3E
81F0: 2E 32 36 3A 3E
81F5: 23 27 2B  202             HEX  23272B2F33373B3F
81F8: 2F 33 37 3B 3F
81FD: 23 27 2B  203             HEX  23272B2F33373B3F
8200: 2F 33 37 3B 3F
8205: 20 24 28  204             HEX  2024282C3034383C
8208: 2C 30 34 38 3C
820D: 20 24 28  205             HEX  2024282C3034383C
8210: 2C 30 34 38 3C
8215: 21 25 29  206             HEX  2125292D31353939
8218: 2D 31 35 39 3D
821D: 21 25 29  207             HEX  2125292D31353939
8220: 2D 31 35 39 3D
8225: 22 26 2A  208             HEX  22262A2E32363A3E
8228: 2E 32 36 3A 3E
822D: 22 26 2A  209             HEX  22262A2E32363A3E
8230: 2E 32 36 3A 3E
8235: 23 27 2B  210             HEX  23272B2F33373B3F
8238: 2F 33 37 3B 3F
823D: 23 27 2B  211             HEX  23272B2F33373B3F
8240: 2F 33 37 3B 3F
```

```
                 212  *
                 213  * SHIFT VALUES FOR THE SEVEN
                 214  * PLOTTING POSITIONS AND MASKS
                 215  * FOR STRIPPING OUT THE
                 216  * REQUIRED BITS
                 217  *
                 218  SHFT1
8245: 00 04 01   219           HEX  00040105020603
8248: 05 02 06 03
                 220  SHFT2
824C: 00 03 00   221           HEX  00030002000100
824F: 02 00 01 00
                 222  MSK1
8253: F0 0F E1   223           HEX  F00FE11FC33F07
8256: 1F C3 3F 07
                 224  MSK2
825A: FF FE FF   225           HEX  FFFEFFFCFFF8FF
825D: FC FF F8 FF

--End assembly--

609 bytes

Symbol table - alphabetical order:
   AN3     =$C05E      BYTE    =$FF        BYTEOK  =$8097      COLR    =$FE
   ERASE   =$8006      EVEN    =$806C   ?  FULLG   =$C052      GRON    =$C050
   HIRES   =$C057      INAUX1  =$80A0      INMAIN  =$8061      LP1     =$8022
   MOD7    =$8048      MODDUN  =$8052      MSK1    =$8253      MSK2    =$825A
   ON80    =$C00D      PG1     =$C054      PG2     =$C055      PHI     =$F9
   PLO     =$F8        PLOT    =$8038      PLOTOUT =$80C1      SH1DUN  =$807D
   SH2DUN  =$80B4      SH2LP   =$80AF      SHFT1   =$8245      SHFT2   =$824C
   SHLP1   =$8078      STAUX   =$C001      T0      =$FA        T1      =$FB
   TABHI   =$8185      TABLO   =$80C5   ?  TXTON   =$C051      XLOC    =$FC
   YLOC    =$FD

Symbol table - numerical order:

   PLO     =$F8        PHI     =$F9        T0      =$FA        T1      =$FB
   XLOC    =$FC        YLOC    =$FD        COLR    =$FE        BYTE    =$FF
   ERASE   =$8006      LP1     =$8022      PLOT    =$8038      MOD7    =$8048
   MODDUN  =$8052      INMAIN  =$8061      EVEN    =$806C      SHLP1   =$8078
   SH1DUN  =$807D      BYTEOK  =$8097      INAUX1  =$80A0      SH2LP   =$80AF
   SH2DUN  =$80B4      PLOTOUT =$80C1      TABLO   =$80C5      TABHI   =$8185
   SHFT1   =$8245      SHFT2   =$824C      MSK1    =$8253      MSK2    =$825A
   STAUX   =$C001      ON80    =$C00D      GRON    =$C050   ?  TXTON   =$C051
?  FULLG   =$C052      PG1     =$C054      PG2     =$C055      HIRES   =$C057
   AN3     =$C05E
```

Listing 2.

```
10  REM  DRAW COLORED SQUARES. MU
     ST HAVE PLOT ROUTINE IN MEMO
     RY
20  REM   SET UP ENTRY POINTS
30 ERASE = 8 * 4096:PLT = ERASE +
     3
40  REM  MX IS MEMORY LOCATION FO
     R X COORDINATE
50  REM  MY IS LOCATION FOR Y COO
     RDINATE
60  REM  MC IS LOCATION FOR COLOR
      VALUE
70 MX = 252:MY = 253:MC = 254
80 C = 1: REM  SET STARTING COLOR

90 L = 139: REM  SET LENGTH OF RE
     CTANGLE
100  CALL ERASE: REM  CLEAR SCREE
     N
110 X = 139 - L:Y = 139 - L: REM
      GET UPPER LEFT CORNER OF SQ
     UARE
120  POKE MC,C: REM  PASS COLOR V
     ALUE TO SUBROUTINE
130  FOR I = X TO L: REM   LOOP T
     O  DRAW EACH SQUARE
140  POKE MX,I: POKE MY,Y: CALL P
     LT: REM  TOP OF SQUARE
150  POKE MY,139 - Y: CALL PLT: REM
      BOTTOM OF SQUARE
160  POKE MX,X: POKE MY,I: CALL P
     LT: REM  LEFT SIDE
170  POKE MX,139 - X: CALL PLT: REM
      RIGHT SIDE
180  NEXT I
190 C = C + 1: IF C = 16 THEN C =
     1: REM  NEXT COLOR
200 L = L - 2: IF L > 70 THEN 110
     : REM  NEXT SQUARE
210  GET A$: REM  WAIT FOR KEY PR
     ESS
220  PR# 3: REM  GO INTO 80 COLUM
     N TEXT MODE
230  TEXT : END
```

Listing 3.

```
10  REM  DRAWING PROGRAM
20  REM  MUST HAVE PLOTTING SUBRO
     UTINE IN MEMORY
30  REM  USE ARROW KEYS TO MOVE A
     ND C TO CHANGE COLOR
40  REM   SET UP ENTRY POINTS
50 ERASE = 8 * 4096:PLT = ERASE +
     3
60  REM  MX IS MEMORY LOCATION FO
     R X COORDINATE
70  REM  MY IS LOCATION FOR Y COO
     RDINATE
80  REM  MC IS LOCATION FOR COLOR
      VALUE
90 MX = 252:MY = 253:MC = 254
100  REM  CLEAR SCREEN
110  CALL ERASE
120  REM  INITIALIZE VARIABLES
130 X = 0:Y = 0:C = 15: REM  X AN
     D Y COORDINATES AND COLOR
140 : POKE MX,X: POKE MY,Y: POKE
     MC,C: CALL PLT: REM  PLOT FI
     RST PIXEL
150  POKE 12 * 4096 + 5 * 16 + 3,
     0: REM   MIXED GRAPHICS AND
     TEXT
160  PR# 3: REM  ENABLE 80 COLUMN
      TEXT
170  HOME : REM  CLEAR TEXT WINDO
     W
180  VTAB 21: PRINT "X=";X;"  ": REM
      PRINT COORDINATES
190  VTAB 22: PRINT "Y=";Y;"  "
200 K =  PEEK (12 * 4096): REM  R
     EAD KEYBOARD
210  IF K < 128 THEN 200: REM  NO
      KEY
220  POKE 12 * 4096 + 16,0: REM
     CLEAR KEYBOARD
230  REM  CHECK FOR ARROW KEYS
240  IF K = 136 THEN X = X - 1: IF
     X < 0 THEN X = 139: REM    L
     EFT ARROW
250  IF K = 149 THEN X = X + 1: IF
     X > 139 THEN X = 0: REM    R
     IGHT ARROW
260  IF K = 139 THEN Y = Y - 1: IF
     Y < 0 THEN Y = 159: REM    U
     P ARROW
270  IF K = 138 THEN Y = Y + 1: IF
     Y > 159 THEN Y = 0: REM  DOW
     N ARROW
280  IF K = 195 THEN  INPUT "COLO
     R? ";C: HOME : REM  NEW COLO
     R
290  IF C < 256 THEN  POKE MC,C: REM
      STORE COLOR IF IN VALID RAN
     GE
300  POKE MX,X: POKE MY,Y: CALL P
     LT
310  GOTO 180
```

Listing 4. Note that HGR and PR#3 take care of the pokes for setting up graphics and enabling the card. Try changing the 0 being poked in line 110 to other values.

```
10  REM  PROGRAM TO INITIALIZE EX
     TENDED
20  REM  HI-RES AND CLEAR THE
30  REM  SCREEN FROM BASIC
40 D$ =  CHR$ (13) +  CHR$ (4): REM
      RETURN AND CONTROL D
50  PRINT D$;"PR#3": REM  TURN ON
     THE CARD
60  POKE 49246,0: REM   STROBE AN
     NUNCIATOR #3
70  POKE 49153,0: REM  ENABLE STO
     RAGE TO AUXILIARY MEMORY
80  HGR : REM  CLEAR MAIN MEMORY
     HI-RES
90  POKE 49237,0: REM  ENABLE AUX
      MEMORY
100  FOR I = 8192 TO 16383: REM
     CLEAR AUX MEMORY
110  POKE I,0: NEXT I
120  POKE 49236,0: REM   ENABLE M
     AIN MEMORY
130  REM  VALUES CAN NOW BE POKED

140  REM  INTO SCREEN MEMORY
150  REM  TO USE MAIN MEMORY, FIR
     ST
160  REM  POKE 49236,0
170  REM  FOR AUX, USE POKE 49237
     ,0
```

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The end of 1984 was a busy time for makers of notebook portables, with each one trying to outdo the competitors, pushing up announcement dates, and practically adding features on the fly. With all the acceleration of announcement dates, we feel sure that some of these units will not hit dealers' shelves for many months. Below are descriptions and our early impressions; watch for in-depth reviews later this spring.

NEC PC-8400

The NEC PC-8400 is a notebook portable with 64K of RAM, 16-line by 80-character display, RS-232 and parallel interfaces, internal 300 baud modem and 96K of built-in ROM software. The built-in software includes *WordStar-To-Go* (a simplified version of WordStar), *Calc-To-Go* (spreadsheet), *Personal Filer* (filing system), telecommunications, and CP/M utilities. The 8400 uses a CMOS version of the 8-bit Z80A running at 4 MHz, the same mpu used in the 8201.

Although the display is in a hinged lid, the entire unit is only 2.25" thick (x 11.75" x 8.5"). The weight is 4.7 lbs., 0.7 lbs. more than the 8201 due to the larger screen on the 8401 and its use of four C cells (rather than the AA cells in the 8201).

The keyboard retains the excellent diamond cursor keys of the 8201. The function keys, however, have grown to a normal size. In all, the 8401 has 68 regular keys, five function keys (doubled to ten using Shift), and four cursor keys.

The angle (contrast) of the LCD elements are adjustable as is the tilt of the screen; we found it very legible in a variety of external lighting conditions. Like the 8201, the 8401 has full cursor addressing, as well as Greek and graphics characters.

The PC-8401A package with cassette and phone cable carries a suggested retail price of $999. An external 32K RAM cartridge costs $199, and printer cable $39.50. We are promised that a CRT/disk adapter ($249), 1200 baud modem ($299), and 3 1/2" disk unit ($599) will be available for the 8401 in something resembling real time.

Tandy Model 200

Essentially, the Model 200 is an enhanced Model 100. Major differences include a 16-line by 40-character tilt-up screen, up to 72K of RAM in three banks of 24K each, 72K of ROM (includes the *Multiplan* spreadsheet), improved cursor key cluster, and enhanced software.

Software changes include a calculator function available from any program; COPY, KILL and BANK switch function key options; formatting of output for text files including width, margins, and page size (but not line spacing); and a LIST function in Text which performs a string search. Up to 255 alarms may be stored in the NOTE file; the Alarm will wake up the machine if power is off at the time of a scheduled event. Several features have been added to Telcom as well.

The machine has grown slightly to 2.2" thick and 4.5 lbs. The price of the Model 200 with 24K of RAM is $999; additional 24K RAM modules (user installable) are $249.95 each. It should be currently available at your local Radio Shack.

Sord IS-11C

Aimed primarily at value added resellers and national accounts is Sord's

NEC PC-8400.

Tandy Model 200.

Sord IS-11C.

new portable, the IS-11C. The machine uses a CMOS 8-bit Z80A mpu, has 72K of ROM, 80K of RAM, a built-in microcassette recorder, 300 baud modem, serial and parallel interfaces, and a 25-line by 80-character fold-up LCD screen.

Built-in software includes a powerful word processing package, telecommunications, scheduling, and several utilities. Other software is available on ROM cartridge and includes Basic, Data Transfer (to and from MS-DOS, PC-DOS, and CP/M), Time Sharing System, and "DB-PIPS" (a combination database, spreadsheet, and graphics package).

The size and weight of the IS-11C is about the same as a pair of Model 100s (3.4" thick and 6.6 lbs.).

The machine will retail for under $1500, and a wide range of hardware peripherals is planned including a portable printer, 3.5" disk drive, bar code reader, and mouse.

TI Pro-Lite

At the high end of the portable (laptop? knee-top?) spectrum is the Texas Instruments Pro-Lite. Essentially, this is a compatible companion to the TI Professional Computer with a CMOS version of the 16-bit 8088 mpu, 256K of RAM (expandable to 768K), built-in 3.5" disk drive with 720K capacity, full-travel keyboard with 79 keys and 12 programmable function keys, and, like the Data General/One, a 25-line by 80-character LCD screen. The basic unit with MS-DOS 2.12 goes for $2995.

The word "Lite" is used as Miller beer uses it—fewer calories than the normal brew, but still quite a few. The Pro-Lite weighs in at 10.5 lbs., not including an external modular battery pack which adds a few more pounds. According to TI's research, many users don't want true portability—they want carry around-ability—so TI made the basic unit AC powered. A modular battery pack ($129), second 3.5" disk drive ($595), or combination battery/disk unit ($724) clamp onto the back of the Pro-Lite. Other available options include an 8087 numeric co-processor and internal 300 baud modem.

To exchange programs and data with a desktop TI Pro (or other PC compatible), a PC interface cable ($79), which connects to the external drive connector of the desktop machine is available. Using this cable, the drive of the Pro-Lite acts as a third disk drive on the desktop machine.

Initially, TI is aiming the Pro-Lite at vertical markets through its direct sales force and value added resellers. It will not be available at retail until later in the year.

TI Pro-Lite.

Datavue 25

Another 80C88, 25-line by 80-character, MS-DOS machine is the Datavue 25. The 83-key keyboard is truly detachable and can be operated in a cordless (infrared) mode similar to the one on the PCjr. Built into the side of the system/display unit is a 360K 5 1/4" double density, double sided disk drive. The machine will be offered with either 64K DRAM chips (128K standard, 256K maximum) or 256K chips (256K standard, 1Mb maximum).

Datavue 25.

The Datavue 25 includes serial and parallel interfaces, battery backup real time clock, 16K ROM with diagnostics and I/O, and fold-away handle. Options include an internal modem and external battery pack.

Buttoned up, the machine measures 13" x 10.4" x 6" and weighs 12.1 pounds without the battery pack. Pricing has not been fixed, but is quoted as "under $2000."

Short Takes

Visual Technology, makers of the Commuter, a 16-pound IBM PC compatible with dual 5 ¼" disk drives, upped the screen size of the machine from 16 lines to 24 lines by 80 characters.

Apple Computer showed its long-awaited 25-line LCD screen for the Apple IIc portable. Spring availability is promised.

Traveling Software announced a nifty software package to download the entire contents of the Model 100 or NEC 8201 to a cassette tape in a fraction of the time needed to download individual files.

And magazine publishing curmudgeon Wayne Green has started *Pico*, a magazine for users of briefcase portables. It's based in WGE Center, Peterborough, NH 03458. ■

Firms Mentioned In This Column

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700 Nicholas Blvd., Suite 10
Elk Grove Village, IL 60007
(312) 228-5900

Tandy/Radio Shack
1700 One Tandy Center
Fort Worth, TX 76102
(817) 390-3011

Sord Computer of America
645 Fifth Ave.
New York, NY 10022
(212) 759-0140

Texas Instruments, Inc.
Data Systems Group
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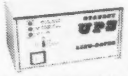

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CIRCLE 162 ON READER SERVICE CARD

APPLE CART

The rumormill; the new product mill.

John J. Anderson and Owen Linzmayer

Howdy, Apple fans. This month Owen and I will once again embark in tandem on an excursion into the wonderful and wacky world of Apple Computer Inc. In case you haven't heard of them, they are the company that buys entire issues of *Newsweek*. They are the company that offers a free overnight stand with their sexy new computer (supply your own driving gloves). They are the company that fields a commercial in which a disgruntled user of "another brand" takes an ax to his computer and trashes it. A wonderful sight, if I do say so myself.

A low profile, indeed. All they need now is the Beach Boys: Hacking USA.

And best-selling computers are not all that is manufactured out Cupertino way. Some of the very best rumors making the rounds this month concern Apple. Topping the list are two turnabouts, both reported, then "unreported" by *InfoWorld* magazine. First the weekly trade magazine reported that Apple would be dropping the Lisa line later this year, in favor of some sort of Monster Mac machine. A week later they reported that Steve Jobs and John Sculley had denied the claim, and in fact had asserted a continuing commitment to the line. At roughly the same time, they quoted a certain Stephen Wozniak on the topic of an Apple IIx, complete with 16-bit 65816 processor, built-in disk drive, expandable memory, and add-on slots. A couple of weeks later they took that one back too, citing a letter from Wozniak that claimed there is no IIx project, and he was speaking of a "wish list" rather than a product Apple is working actually on. Oh, sweet mysteries of life.

On the Macintosh rumormill, the grind is much the same as it was when Arlan Levitan reported on it way back in July 1984. Heading the list, of course, is the ever-elusive color Mac. This beast, which I still reckon to be about as real as old Nessie, is most prevalent because color is most coveted by current Mac fans. Like images of sugarplums, the concept fairly dances in their heads. As I stated in my initial review of the Mac, holding one's breath on this score is highly inadvisable.

Much more feasible is the one about a Mac with an 8.5" x 11" screen, capable of displaying a full page at a time. An attractive idea, especially if capable of multitasking. How about the one concerning the Mac with internal hard disk? You can make that one come true now, with the help of a third party product (see below). It is rather likely, too, that Apple will introduce such a product itself in the future. One rumor I pray to be false, however, is that of the Unix Mac. The idea itself is enough to conjure visions of a woof bag. I can only assume that this model will sport a wireless, infrared mouse, and be tinted light blue.

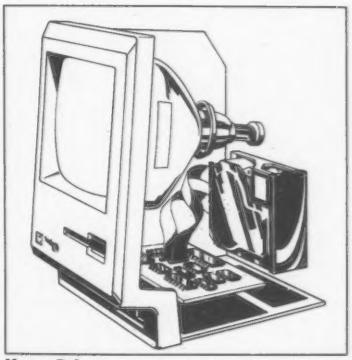
One report I have faith in puts the backlog of orders for 512K upgrades at over 20,000, and further states that the Fat Mac now accounts for 30% of total Mac sales. Judging from the problems I had obtaining a Fat Mac under Apple's editorial program, I can believe it (they get my firstborn son, but it is still a great deal). Once you sit in front of a Fat Mac you're spoiled for life. (For more on that topic, see the Fat Mac review elsewhere in this issue.) Packaged with hard disk, some good 512K software, a set of leather driving gloves, and a case of Pepsi, it will be a tough offer to refuse.

Macintosh sales in general continue to increase, despite the overall industry slump. According to *InfoWorld*, Apple is now gearing its automated facilities to move production to over 100,000 units a month. According to *Time* the Mac logged the most successful introduction ever of a new micro.

Enough gossip—time to get down to the hard stuff. Here is the Mac Comdex Floor Report:

General Computer Hard Disk

General Computer unveiled HyperDrive, a compact 10-meg hard disk drive that neatly fits the Macintosh internally. Because the HyperDrive interface logic board is directly connected to the Mac motherboard, both serial ports remain free for modem and printer use—a great convenience. Macs equipped with the unit can boot from either hard disk or floppy.



Hyper Drive.

The system software provided with HyperDrive allows the hard disk to divide into many "virtual disks" which automatically resize themselves to accommodate the user's files. As they interface in parallel, as hard disks ought to, the new units can also transfer data seven times faster than Macs with external hard disk drives.

HyperDrive is available in two models: one including Fat Mac memory expansion to 512K RAM ($2795), and one without memory expansion ($2195). This product will excite many Mac owners, and I hope to give you a definitive hands-on review of this one very soon.

Micro-Design Hard Disk

Micro-Design announced The Keeper, a hard disk drive available with up to a whopping 33-meg, and a print buffer standard. The Keeper is available with fixed and/or removable disk cartridges. You can choose from a 5-meg removable ($2195), dual 5-meg removable ($3495), 10-meg fixed and 5-meg removable ($3495), as well as a 10-, 20-, and 33-meg fixed cartridge drives

($2095, $2595, and $3195 respectively).

The Keeper connects to the printer port of your Macintosh. Your Imagewriter printer connects to the back of the Keeper. The built-in printer buffer eliminates wait times during print-out, returning the Mac to your control. The buffer adjusts to the size of the document—up to 1-meg, or about 312 pages.

Volume partitioning allows you to define partitions on the disk to be accessed as though they were separate, smaller disks. This eliminates the overload problem as it exists with the current revision of the Finder. An installation and sizing program guides you through the process.

ExperLogo

On the software side, ExperTelligence previewed its new, high performance version of the Logo programming language, dubbed ExperLogo. Because of its ease of use and English-language syntax, Logo has gained wide acceptance as a beginner's language. Its makers claim that enhanced features make it an even better choice as an introductory language, while increased function and speed make ExperLogo a contender as a serious program development language.

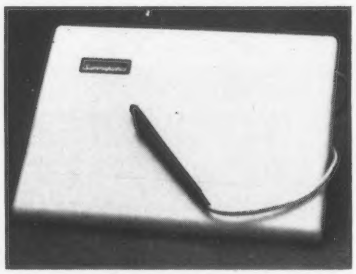
Integration of the Macintosh user interface techniques, including pull down menus, multiple windows, help screens and extensive use of the mouse, lend credibility to that claim. The speed—up to 100 times faster—is a most visible and welcome change from existing Logos. A 512K version of the program will appear interpreted but actually be a compiled version of Logo, accounting for the massive increase in execution speed.

Alongside standard turtle graphics, so-called Bunny Graphics extend the range of ExperLogo. Bunnies traverse the screen at amazing speeds, hop around on the surfaces of spheres, and are able to traverse 3-D space. Other new features include load on call, data file handling, and the ability to use data arrays. What's it cost, Doc? $129.

Summagraphics Tablet

Summagraphics Corporation announced the MacTablet, a 6" x 9" graphics tablet for the Macintosh. The MacTablet with stylus lets Mac users turn their systems into real graphics workstations, by making entry as easy as putting pen to paper. Drawings can be traced from a single piece of paper or from originals up to 0.5" thick, such as magazines or notebook drawings. MacTablet is compatible with *MacDraw*, *MacPaint*, and all Macintosh software.

In our initial review of the Mac, our then-resident computer artist complained that the mouse was an unwieldy drawing device. I'm sure she would have much preferred the MacTablet. The unit can be used in conjunction with the mouse, so there is no need to plug and unplug. Its ergonomic design provides a tilt mechanism for easy adjustment. $495.



Summagraphics MacTablet (above) and a portrait done with MacVision from Koala (below).

Koala MacVision

MacVision links the power of the Macintosh with the power of video technology in an exciting manner. Attached to any standard video source, MacVision creates a digitized, photographic image that can be modified and manipulated through *MacPaint* or other application program. Any RS170 video source can connect with the product: video camera, VCR, video disc, even another computer—$400, minus video source. The output is a high-quality digitized image (see accompanying image of our fearless leader). The first step toward teaching your Mac to see.

Dave will present a full review of MacVision in an upcoming issue.

ThinkTank 512

Living Videotext introduced *ThinkTank 512*, a program designed specifically for the Fat Mac, that combines outline processing, word processing, and graphics. It is the anticipated companion product to *ThinkTank 128*, which handles outline processing alone in 128K.

ThinkTank 512 is designed for managing ideas, details, planning, organization of data, and high-performance word processing with graphics. Its flexible outline functions enable you to focus on selected areas to work on details, then move to the big picture with the click of the mouse. *MacPaint* graphics or graphics from other programs can be pasted into *ThinkTank* documents. The program automatically labels the graphics in outline form and creates a reference library.

Designed to take full advantage of the Fat Mac, *ThinkTank512* can handle up to 3000 headers, with 35 pages of text maximum per header. It also offers new printing formats and more printing options.

Enough from me already. Apple does not live by Mac alone. I hand the reins to my friend and colleague Owen Linzmayer, who will bring you up to date on the world of the Apple II series. Take it away pal!

* * *

Thank you John, for that warm, gushing introduction. It is a pleasure to have you along for this edition of the Cart—drop by anytime. While much attention of late has been focused on the IIc and the Fat Mac, the Apple IIe continues to sell tremendously well. Too well. Orders for the IIe can't be filled fast enough, and new orders are piling up daily.

Apple has offered to fill IIe backorders with the more expensive IIc, but this gesture can hardly stem the tide. Apple has been forced to increase production of the IIe, the machine that just won't fade away.

So, let's see what we have for the multitudes of Apple IIe owners among you (sound of paper shuffling on the desk of an overworked assistant editor). Ah yes, here it is, the Multi I/O board from AST Research. Best known for their add-on boards for the IBM PC, this Irvine, CA, firm is now offering its first Apple product, the Multi I/O for the IIe.

Multi I/O is a single board interface with three popular peripheral functions: printer serial port, serial communica-

tions interface, and a ProDOS-compatible clock/calendar with battery backup. All this for just $235.

Multi I/O

The Multi I/O board comes in its own static-free plastic bag and is packaged with a 30-page manual and a ProDOS-based utilities disk. Installation of the Multi I/O is a simple matter of attaching the supplied interface cables, configuring the board, choosing a slot (1, 2, or 7) and inserting the card.

Before we look at Multi I/O features a word or two on configuring the card.

On the bottom righthand side of the card is a red DIP switch. Tabs 1-4 on this switch set the baud rate (50-19200) for the serial printer port. Tabs 5-8 correspond to the communications port. It is important that equipment interfaced to these ports be configured to the same baud rate as the port itself.

In addition to this DIP switch, there are two configuration blocks that must be set identically for proper operation. These bars of jumpers delineate where the various functions of the Multi I/O will be mapped. The printer port may be mapped for slot 1 or 2, the communications port for slot 2 or 3, and the clock for slot 4 or 7. Any or all of the functions may be disabled by not mapping to a slot (that is, remove the shorting block from the pin corresponding to that function). Finally, there is a jumper block that acts as the write-protect for the clock.

Once installed, the first thing you should do is set the clock to the correct time and date. Having done this, the board will retain this information even when the computer is turned off, thanks to a lithium battery built into the board itself.

The advantages of a real-time clock are obvious to most—time and date stamping of files, stopwatch accuracy for timing functions, and keeping a computerized appointment book, just to name a few. Unfortunately, the problem with all clock peripherals, not just the Multi I/O, is that each is accessed in its own unique way, and software must be written specifically for the particular clock that you have installed in your computer.

While Thunderware, Inc. of Orinda, CA, has more or less set the de facto standard with its Thunderclock card, not everyone adheres to the "standard." If you are going to be writing your own clock applications, all you must do is follow the specifications set forth by

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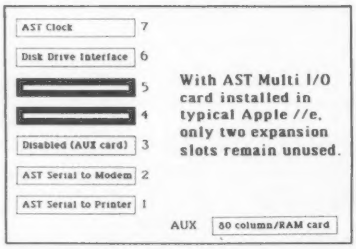
AST Clock 7
Disk Drive Interface 6
5
4
Disabled (AUX card) 3
AST Serial to Modem 2
AST Serial to Printer 1
With AST Multi I/O card installed in typical Apple //e, only two expansion slots remain unused.
AUX
80 column/RAM card

Figure 1.

the manufacturer of your clock. AST Research includes in the Multi I/O manual a short tutorial on accessing the clock via Applesoft commands.

The printer port on the Multi I/O allows you to connect virtually any serial printer to your IIe, though Apple's Imagewriter is the printer of preference. The number of word and stop bits, as well as the parity, can be software selected. Only external modems can be attached to the serial communications port of the Multi I/O, and a smart modem must be used if you wish to take advantage of the built-in telephone dialer feature.

As I mentioned before, the Multi I/O comes with a ProDOS-based utilities disk. The disk is self-booting and comes up with a menu from which you may choose the following options:

- Tutorial
- Clock Utility
- Telephone Dialer
- Text File Listing Utility
- Terminal Program
- Graphics Printing Utility

The Multi I/O provides three of the most popular peripheral options all on one board, but unfortunately, it uses up three slots, though it occupies only one. If, for example, you set the printer port for slot 1, the communications port for slot 2, and the clock for slot 7, nothing can be in those slots—with the exception of the Multi I/O, of course. And assuming that you purchased the board because you want to do word processing, you almost certainly have an 80-column card in the auxiliary slot (this disables slot 3).

Naturally, you have a disk drive interface card plugged in somewhere, so if you take advantage of all the Multi I/O features, you are left with only two open slots (see Figure 1).

On the bright side, the Multi I/O reduces power consumption, and doesn't block the flow of air inside the computer as much as three boards would.

If you are looking for a no frills way to give your Apple IIe two serial interface ports and a real-time clock, you will look long and hard to find three separate boards with the same features at a comparable price.

Well, that's about it for February. I hope we have satisfied your hunger for Apple information. Both John and I can be reached on the CompuServe telecommunications network. Our PPNs are 76703,654 and 72255,1560, respectively. We're in touch, so you be in touch. ■

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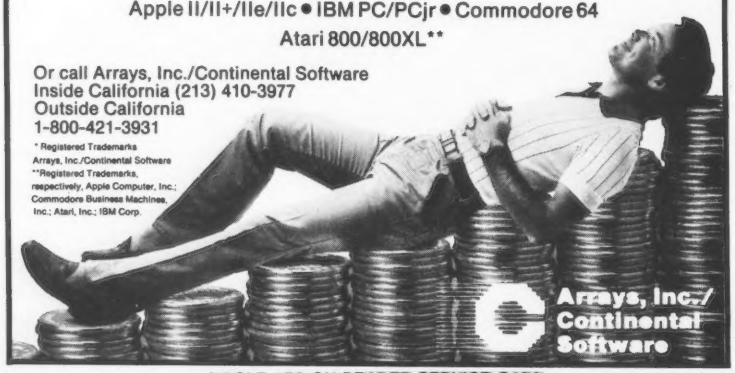

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Heath/Zenith	E	P
IBM	F	Q
Radio Shack/Tandy TRS-80	G	R
Texas Instruments	H	S
Timex Sinclair	I	T
Other (specify)	J	U
None	K	V

3 For what, if any, business application(s) do you use the microcomputer you currently own?_____

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Other (specify)	J	U
None	K	V

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Timex Sinclair	I	T
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None	K	V

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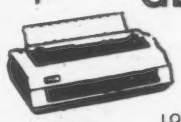

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CIRCLE 135 ON READER SERVICE CARD

IBM IMAGES

An old friend takes a hard look at the IBM product line

Will Fastie

Surprise, I'm back. Some of you will, hopefully, remember me as the originator of this column. For those of you who never heard of me, at least I start with a clean slate. As for why I'm back, well, Susan decided to retire (nice work if you can get it), and *Creative's* esteemed editor, Betsy Staples, waved the column in front of my nose. A friend of mine is fond of telling stories about her father's folk wisdom; one of his sayings is "Never pass a water fountain without taking a drink." I feel the same way about this magazine.

To celebrate this rite of passage, I'm going to take a look backward at some of the things that have happened in the IBM market over the past 18 months and comment on them. The reason for doing so is simple. In that period of time, IBM has made several announcements that have changed the marketplace, challenged the competition, and indicated new directions for the world's largest computer maker.

PCjr

Since the announcement of the PC in August, 1981, IBM's only major stumble has been the original incarnation of the PCjr. So bad was their judgment about the keyboard that the mistake would have driven a lesser firm out of business. To IBM's everlasting credit, they bowed to the pressure and replaced the keyboard, even as they were lowering the price of the system. Better yet, they made the original purchasers of PCjrs feel *very* good by giving them the new keyboard outright. They didn't even ask for the old ones back, although I can't imagine what they would have done with them anyway. Estimates on the number of keyboards given away seem to average about 75,000!

With the keyboard problem solved, IBM redoubled its efforts to market the machine. An enormous ad campaign was launched, including 12-page inserts in major magazines and a blitz on TV. The pitch has been good, and I think quite valid. IBM is even doing a good job defending the machine against claims that there is too little software for it (there really isn't), claims launched primarily by Apple in their TV spots for the IIc.

A veritable flood of software has been made available for the machine, both by IBM and other vendors, and much more software, including most PC programs, will run if an IBM or Tecmar memory expansion "sidecar" is added. In a key move, IBM added a painting program like Apple's *MacPaint*, effectively defusing one of Mac's most important selling features. In a killer move, IBM has been advertising the fact that *Lotus 1-2-3* is available in cartridge form for the 128K PCjr, no memory expansion required. Holy smokes.

The remainder of the story is Christmas, and it has two parts. First, I spent my usual amount of time this year talking to friends, relatives, and others, giving forth my Christmas computer buying advice. In sharp contrast to previous years, most people who consulted me did not wish to consider machines at the low end; most had already decided upon the PCjr and wanted only further independent confirmation.

Second, discounting for the machine has been rampant. On Thanksgiving Day, I read an IBM Product Center ad offering a PCjr with IBM PCjr Color Monitor and $200 worth of software (enough to buy any version of DOS and the Basic cartridge) for $999, a deal good through December. Usual list price for system and display: $1428. In effect, IBM is saying "Buy a PCjr, and we'll throw in the monitor for free."

The bottom line is simple: IBM has a *very* good story to tell. PCjr is appropriately priced and affordable (IBM offers credit, too), well-equipped, expandable, supported by a ton of software offerings, and backed by IBM. I find the story completely irresistible.

So does the consumer. In October, according to *Future Computing*, sales of the PCjr matched the combined sales of Apple's IIc and IIe models; IBM was expected to outsell Apple in November and December.

PC/AT

In the face of mounting competitive pressure against the venerable PC and the industry-standard XT, IBM announced a new machine and designated it the AT, for advanced technology. It is not so advanced but it is taking the market by storm.

You have probably heard almost everything about the AT by now, so I won't bore you with details (but see *PC Tech Journal*, vol. 2, no. 6, December 1984, beginning on page 30 if you want the whole story). There are some important but very simple facts about the AT that can tell you all you need to know.

First, the machine is extraordinarily compatible with the members of the PC family. Just about everything I have tried to run on the AT does run, and the exceptions usually are known to violate PC rules rather severely. In the hardware department, IBM designed the bus of the system to be 16 bits wide but to also accommodate the older 8-bit adapter boards designed for the PC or XT.

Second, the fixed disk controller is included with every system even if the fixed disk is not purchased. I consider this very important because it means that third-party vendors can provide disks with greater capacities than the IBM drives while at the same time remaining 100% compatible at the controller level. Because software is included in ROM on the IBM disk controller, such vendors would have a hard time duplicating the controller. Now they don't have to.

Third, the PC/AT is wildly expand-

Display Type	Monochrome		Color		Enhanced Color	
IBM Model	5151		5153		5154	
Price	$275		$680		$849	
Adapter	**Monochrome**	**Enhanced**	**Color**	**Enhanced**	**Enhanced**	**Enhanced w/memory**
Price	$250	$524	$244	$524	$524	$723
Total Price	$525	$799	$924	$1,204	1,373	$1,572
Text						
- Screen Size	25 x 80	25 x 80	25 x 80	25 x 80	25 x 80	25 x 80
- Char. Size	9 x 14	9 x 14*	8 x 8	8 x 8	8 x 14	8 x 14
Color and Graphics						
- Medium Res	No	No	320 x 200	320 x 200	320 x 200	320 x 200
Number of colors			4	16	16	16
- High Res	No	No	640 x 200	640 x 200	640 x 200	640 x 200
Number of colors			2	16	16	16
- Enhanced	No	640 x 350	No	No	640 x 350	640 x 350
Number of colors		2			4	16**

*8 x 14 in graphics mode
**16 colors from a palette of 64

Table 1. Capabilities of IBM Display Subsystems.

able. If we just consider IBM-supplied memory, a machine with 3Mb can be constructed. With third-party products, 15Mb is attainable. This is not for everybody, certainly, but users with large, special-purpose programs will sing for joy. Regarding disk capacity, IBM has apparently designed for drives with up to 100 Mb, of which the AT can support two. And with eight full-sized slots, the AT user should be able to configure just about any imaginable system.

Fourth, IBM stuck with PC-DOS, although they did announce a version of Unix, Microsoft's Xenix, for the new machine. The new 3.0 version of DOS (soon to be 3.1) runs on all members of the PC family, from junior on up. This brings tremendous unity to the family, a degree of compatibility unknown from any other vendor, and confidence that investments in software for one family member will not be lost should an upgrade to a newer or bigger machine be made.

Fifth, the machine hums right along. A somewhat conservative 6MHz clock rate coupled with the 16-bit bus gives the processor a crisp performance. What really makes the difference, though, is the disk subsystem. It is not as fast as it could be (IBM is still buffering the transfers), but it is about three times faster than the XT. Between processor and disk, performance is a new standard.

Finally, the PC/AT is priced aggressively. It is not cheap, but you get a great deal of value for the bucks. The pricing is so good that list prices make the XT look very unattractive. XTs have been selling at substantial discounts since the AT was announced and are actually a pretty good deal at the moment.

Another good story from IBM. The word is that everyone is working on clones. That may be the surest sign of success for the AT: imitation is the sincerest form of flattery.

Graphics

A big disappointment for me was the lack of a new display adapter board at the time the PC/AT was announced. It turns out that IBM was saving it for another time and purpose.

IBM has decided that the engineering and scientific markets are now large enough that IBM needs to enter them more aggressively. Toward that end, they announced a range of products designed especially for that market. As part of the strategy, they presented us with two new color graphics subsystems for the PC, XT, and AT: The IBM Professional Color Graphics subsystem, and the IBM Enhanced Color Graphics subsystem. They are both great, and they really round out the AT.

The lesser of the two, from the consumer point of view, is the Professional subsystem. The pricey combination of display ($1295) and adapter board ($2995) offers high resolution, broad color choices, and an on-board 8088 processor to perform numerous graphics tasks. In concert with an AT, a formidable graphics workstation is created.

More appealing to the mass market is the new Enhanced Color Graphics Display ($849) and the Enhanced Color Graphics Adapter ($524 to $982 depending on options). The adapter can be used to drive any IBM display. On the IBM monochrome display it can generate the current high quality text (characters are 9 by 14 pixels) as well as graphics with a resolution of 640 by 350. On the IBM Color Display (model 5153) or compatible RGB monitor it can duplicate all of the standard color graphics modes, but also delivers 16 colors to both medium- and high-resolution graphics. On the new Enhanced Display (model 5154) it can duplicate the old modes and can produce images with a resolution of 640 by 350 pixels using 4 to 16 colors. Table 1 shows the various configurations, prices, and specifications.

The enhanced adapter and display deliver stunning color and very fine resolution. The text display is not as good as the monochrome display, but is excellent nonetheless. What IBM has done is given us an answer to the two-display dilemma. With this subsystem, high quality text and color graphics can be ours with a single subsystem. Table 2 shows some interesting pricing information. Although the new subsystem is not cheaper, it certainly reduces the requirement for desk space.

Along with the new display subsystems, IBM announced graphics development software. This is not windows, but

it is software that allows software developers to speed the process of building graphics applications. Coming from IBM, it also establishes a *de facto* standard for the graphics interface—a not unimportant consideration.

IBM's story on the graphics front is now very strong and can be challenged only on the battlefield of price. Even there, competitors will have to deliver full compatibility, something that will take them some time.

The Author's System

On a more personal note, I have been watching the market all this time and have finally succumbed to some of its pressures.

I bought a mouse, a Mouse Systems PC Mouse. I wanted to be able to use the *MacPaint*-like programs; Mouse Systems was the choice because that is the one I always see in the IBM booth at trade shows, so I figured it was a good buy for the future. The price has been dropping like a rock and is especially good from PC Connection. By the way, the current model of PC Mouse (M2) is head and shoulders over the first, which was good. An important improvement is the pad, which got quite a bit smaller.

I decided to retire my 9" black and white TV, so I bought the Sears RGB monitor/color TV/composite monitor combination unit for a total price of about $375. It is a fine RGB device for the money, much better than the IBM PCjr monitor in my book. Charged it to my Sears card, too.

Purchase Two IBM Displays	
IBM Monochrome Display and Printer Adapter	$ 250
IBM Monochrome Display (5151)	275
IBM Color Graphics Adapter	244
IBM Color Display (5153)	680
Total	$ 1,449+
Purchase One IBM Enhanced Subsystem	
IBM Enhanced Color Graphics Adapter	$ 524
IBM Enhanced Color Display (5154)	849
Subtotal	1373
IBM Graphics Memory Expansion (allows 16 colors instead of 4)	199
Total	$1,572

Notes:

1. The enhanced subsystem lacks a parallel printer port. The cost of the port has not been included in the analysis because the bulk of installed PC's include multi-function boards or other sources of the port. Price of an IBM parallel port ranges from $75 (PC, XT) to $150 (AT).
2. Dual display and adapter options from other vendors are available for the PC, XT and AT which are significantly less expensive than the IBM products.

Table 2. Comparison of Dual Display vs Enhanced Display.

I bought a Texas Instruments Omni 800 Model 855 printer, usually referred to as the TI 855. Fantastic machine. Control panel, font cartridges, paper feed options, and compatible at the programming level with both the Epson MX *and* Diablo 630. An optional board makes it compatible with the IBM Graphics Printer. It offers reasonable fast draft quality and very, very good letter-quality. The design of the unit is superb; its manufacture leaves something to be desired. I have had particular trouble with the membrane control panel and spontaneous page feeds. So I'm screaming at TI, but I still love the thing. I'll keep it until I can afford a laser printer (sigh). I sold my IBM printer (pre-graphics but including GrafTrax) to a friend for a truly horrible loss.

On the software front, I am still using *WordPerfect*. I have seen version 4.0 and like it. I am also a Turbo Pascal fan and use it now for programs of medium complexity instead of Basic.

It is the best software value I have ever seen. I still do not use a home finance program, because I still don't think any of them are worth the investment, not of money, but of the time they take to learn and use. I used *PC/Taxcut* from Best Programs to do my taxes last year and liked it enough to order the update for this year. I'm hanging on to DOS 2.0, but expect to move to 3.0/3.1 as soon

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CIRCLE 166 ON READER SERVICE CARD

as Tall Tree gets JetDrive (and their fantastic program *Jet*) ported. More on *Jet* next month.

A PCjr is winging its way to me and should arrive here soon. I'm considering the Enhanced Color Display subsystem for the PC. The thought of all that nifty graphics capability makes me want to wrap an AT around it, though, so my fantasies are somewhat hard to deal with at the moment.

And I'm still using the same, old, reliable, oak table upon which I first installed my PC a lifetime ago. ■

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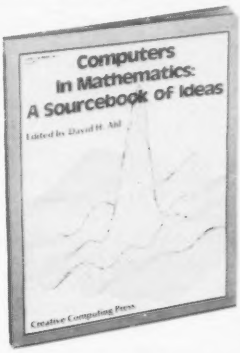

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TANDY GRAM

Using vectors to disable the Break key

Jake Commander

I forgot to say it last month, but I'll get it in while it's still early in the year: I hope that 1985 will be a better one for microcomputing. Without a doubt, 1984 hurt many businesses in the industry. The year saw what was called a big shakeout (a self-fulfilling prophesy if ever I saw one).

Thankfully, due to the size of the corporation, (and I'm sure the management would also like to claim some responsibility) Tandy was dented only minimally during a year which saw the demise of many microcomputer-related companies. We lost quite a few magazines, too.

So everybody knock on wood; we've a lot to be thankful for in the TRS-80 world. As an interesting aside to the main direction of the column this month, I've shown some figures for Tandy's growth over the last three years which seem to indicate that the company is weathering the storm respectably.

Back to the Break Key

Back to the main thrust as promised last month. After a good break, you should be ready for another—but this time, the Break key. If you read the column last month, you will recall that I'm looking at ways of commandeering the Break key during the execution of a Basic program. The idea is not to lock it out for security reasons but simply to protect the user of a program from landing in the lap of Basic.

This may be no big deal to seasoned programmers, but you don't have to be literate in Basic to run an accounts payable package, and an operator of such a program deserves something better than being tossed out of a familiar program environment just because he accidentally hit the wrong key. Moreover, creative use of the Break key can deliver all sorts of benefits in a Basic program. That is why many dialects of Basic now feature an ON BREAK GOTO command. By following the logic about to follow, users of the Models I/III/4 and Color Computers will have an equivalent feature.

I freely admit that I didn't anticipate the circuitous route I ended up taking in the solution of this problem. When I wrote about "another method" in last month's column, I knew what I meant, but those comments look like bravado after what I've just been through.

Many surprises were lurking in bits of interpreter machine code. Some of them took me by surprise; so much so that I ended up spending ten times my estimated time on this project. If it hadn't been for my disassemblies of the Basic ROMs, I wouldn't have finished this for about another two months.

Vectors are useful because by changing them, the behavior of particular routines can be altered in a predictable fashion.

Let me explain what the technique we're looking at is all about. If you remember, last month we redirected the RST 40 processing on the Model I/III/4 (from here on, I'll just say Model 4). This RST 40 had relevance only because it is invoked at the machine code level whenever the Break key is hit. There is no magic behind this; it is simply there in ROM on the Model 4. Whoever wrote the code in those ROMs meant for a RST 40 to occur whenever Break was pressed. Even better as far as our designs go, the RST 40 vectors out through RAM.

Vectors Explained

Now I've said it: vectors out. That's what this technique relies on: vectors. As I remember from my high school math, vectors are quantities that have both magnitude and direction. In the computer-related use of the word, they have only direction. (Maybe what happens at the other end qualifies as magnitude.)

Vectors are merely jumps to machine code routines. By virtue of the fact that they are there to be changed if desired, they are always in RAM. Vectors are useful because by changing them, the behavior of particular routines can be altered in a predictable fashion.

For instance, many programs have RAM vectors to the input or output routines. By changing the keyboard input vector to point at an RS-232 input routine, a program which normally receives keyboard input can be operated remotely—just by changing the direction of the vector. Remember, a vector is only a jump; hence the idea of direction. In this example the jump would go to a serial input routine rather than a keyboard one.

Their versatility and ease of use is why vectors are considered good programming practice. The point is that the vectors have to be consciously put there to make this versatility available. Without them in a ROM-based system, you are stuck with whatever is burned into the ROM. Fortunately for us, they are present in our ROM Basic interpreters.

The name given to this seemingly nefarious activity has a ring of felony about it: vector stealing. I just love that description. I rub my hands together in glee every time I steal a vector and achieve an increase in the performance of my computer.

Vector Theft

So, let's steal some vectors. I should say that sometimes it is not necessary actually to steal. A wiser approach is often to borrow. The following example will show you what I mean.

Imagine, as I just described, that somewhere a keyboard input vector was

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CIRCLE 114 ON READER SERVICE CARD

"stolen" to facilitate serial input instead. It is the word "instead" that results from vector stealing. By replacing the vector which does a "jump to keyboard scan" with one that does a "jump to serial scan," you lose the ability to communicate via the keyboard.

However, if the "jump to keyboard" is placed at the end of the serial input scan, the keyboard is scanned as before if no serial input is available. Thus, you have both keyboard and serial input available. This is more accurately described as borrowing rather than stealing. When I first got my Color Computer, I used the exact scenario described to enter programs from my Model I into the Color Computer without losing my Color Computer keyboard input.

Within the Basic interpreters of both the 6809 and the Z80 machines, Tandy installed quite a few vectors from ROM into RAM. Usually these vectors point straight back into ROM routines until a disk unit is installed. Then they point to upgraded routines in the disk operating system. The problem is that to discover where the vectors are placed and what their intended use is, I had to disassemble and document the Model I and Color Computer ROMs. This is guaranteed to fry many brain cells, and the only reason I did it was because I thoroughly disliked not knowing what was going on inside those machines.

Among the vectors I found was one that does exactly what we want here. It allows some kind of processing to be done between each and every Basic statement in a program, including statements between colons. In the Model 4, this vector is at 41C4. In the Color Computer it is at location 019A. This vector points to a routine that does the particular keyboard scan which allows a BREAK, a PAUSE, or an INKEY to occur. Perfect. Redirect this vector, and we can trap the Break key ourselves. Not only that, but we'll be trapping the Break key only during execution of a Basic program.

Listing 1.

```
0000 E5       00100          PUSH    HL          ;Save line pointer
0001 2E04     00110          LD      L,4         ;Look 4 bytes back...
0003 AF       00120          XOR     A
0004 67       00130          LD      H,A
0005 39       00140          ADD     HL,SP       ;...into stack
0006 3E21     00150          LD      A,21H       ;1st byte to check
0008 BE       00160          CP      (HL)        ;Correct?
0009 2004     00170          JR      NZ,NOT      ;No, exeunt
000B 23       00180          INC     HL          ;Point 1 further back
000C 3E1D     00190          LD      A,1DH       ;2nd byte to check
000E BE       00200          CP      (HL)        ;Correct?
              00210 ;
              00220 ; Don't check inkey if we weren't called
              00230 ; from 1D1EH (between Basic statements).
              00240 ;
000F E1       00250 NOT      POP     HL          ;Restore line pointer
0010 C0       00260          RET     NZ          ;If not 1D1EH
              00270 ;
0011 D1       00280          POP     DE          ;Destroy RET to 35BH
0012 CD5803   00290          CALL    358H        ;Scan keyboard
0015 B7       00300          OR      A           ;Was key pressed?
0016 C8       00310          RET     Z           ;No, continue Basic
0017 FE01     00320          CP      1           ;Was it break?
0019 2809     00330          JR      Z,BREAK     ;Yes, trap it
001B FE60     00340          CP      60H         ;Shift at?
001D CC8403   00350          CALL    Z,384H      ;If so, await key
0020 329940   00360          LD      (4099H),A ;Save inkey chr
0023 C9       00370          RET                 ;Continue Basic
              00380 ;
              00390 ; Break has been detected
              00400 ;
0024 110401   00410 BREAK    LD      DE,260      ;Line # to GOTO
0027 CDD21E   00420          CALL    1ED2H       ;Find line #
002A C3251D   00430          JP      1D25H       ;GOTO it
              00440 ;
0000          00450          END
```

Listing 2.

```
10 MC$=".....................................................":'45 dots
20 ML=PEEK(VARPTR(MC$)+1):MM=PEEK(VARPTR(MC$)+2):MC=ML+MM*256:FO
RX=MCTOMC+44:READZ:POKEX,Z:NEXT
30 POKE16836,201          'Disable vector
40 POKE16837,ML:POKE16838,MM:POKE16836,195
100 DATA229,46,4,175,103,57,62,33,190,32,4,35,62,29,190,225,192,
209,205,88,3,183,200,254,1,40,9,254,96,204,132,3,50,153,64,201,1
7,4,1,205,210,30,195,37,29
240 CLS
250 A=A+1:PRINTA;:GOTO250
260 A=0:GOTO250
```

The Snag

Like a good guy, I tried borrowing the vector as I described. Both attempts on the Model 4 and Color Computer ended in abject failure. It took hours of poring over disassemblies to find out why. For the record, here's what I found.

On the Model 4, I run under LDOS. This DOS uses the vector for its own Break trapping and was liable under certain circumstances to seem to fabricate a Break out of thin air. In reality, it was reacting to the very Break I had just trapped because it scans for that key during interrupts. As it was going behind my back despite the fact that I borrowed and didn't steal, I went ahead and stole.

Using my method here, LDOS (and whatever DOS you use) won't get a chance to do any inter-statement processing of its own. This routine takes total control. Listing 1 shows the machine code which is redirected to by the vector at 41C4.

The first thing it does is to check if two calls back were made from within the interpreter at 1D1E—the inter-statement processor. This little bit of code is necessary because the same vector at 41C4 is used between the lines of a listing to allow PAUSE or BREAK (and also INKEY!) between lines of a listing. If we did come from the right place, we do our own key scan. Now if Break is detected, we load the DE register pair with the desired line number and make a beeline for it. It looks so easy after it has all been researched.

The Basic program to POKE this machine code routine into a string and then execute it is shown in Listing 2. Somewhere after the number 17, you will see the numerals 4 and 1. This is the line number to jump to in Z80 order ("4" + "1" * 256). Change these if you want a

```
0000 1C    AF      00100          ANDCC   #$AF
0002 BD    A1C1    00110          JSR     $A1C1
0005 81    03      00120          CMPA    #3
0007 27    07      00130          BEQ     BREAK
                   00140
0009 4D            00150          TSTA
000A BD    ADEE    00160          JSR     $ADEE
000D 7E    ADA5    00170          JMP     $ADA5
                   00180
0010 CC    0104    00190 BREAK    LDD     #260
0013 7E    AEB4    00200          JMP     $AEB4
           0000    00210          END
00000 TOTAL ERRORS

BREAK    0010
```

Listing 3.

```
10 POKE410,57  'DISABLE VECTOR
20 MC$="....................."
 '21 DOTS
30 MM=PEEK(VARPTR(MC$)+2):ML=PEE
K(VARPTR(MC$)+3):MC=MM*256+ML:FO
R X=MC TO MC+21:READZ:POKEX,Z:NE
XT
40 POKE411,MM:POKE412,ML:POKE410
,126
100 DATA28,175,189,161,193,129,3
,39,7,77,189,173,238,126,173,165
,204,1,4,126,174,180
240 CLS
250 A=A+1:PRINTA;:GOTO250
260 A=0:GOTO250
```

Listing 4.

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Table 1.

different line number. However, remember last month's caveat about bytes 0 and 34.

Color Computer Antics

The Color Computer had even worse tricks up its sleeve. I have no respect for routines which commandeer the routines I have just commandeered. This is precisely what it did. First I borrowed the vector like a good guy, and then I stole it like a bad one. Both times my machine code was totally ignored—well, not totally.

During the debugging, I placed a CLS call before my Break key scan. Theoretically, the screen should have cleared between Basic statements. It cleared only once.

I hated this one. Why had I successfully stolen a vector only to be treated as if I wanted to use it only once? Eventually, to my great amusement, I found that Color Extended Basic steals its own vector. And no good guy stuff either—it steals it completely.

So what was happening was that I stole the vector from Basic, and Extended Basic stole the vector back from me. When I borrowed the vector, I was handing that very vector back over on a plate.

Not only that, but when I stole it, it stole it right back. It turned out that as soon as I ran a Basic program, the first colon or end of line vectored to this heartless routine which never used the vector again. This routine did its own Break check, and my routine was cheated.

The Solution

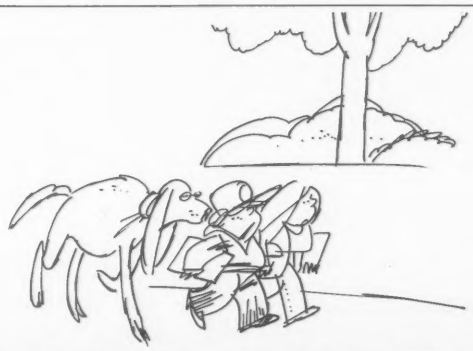
The solution is in line 10 of Listing 4. By disabling the vector before even a single end of statement, the nasty routine doesn't get a chance to bypass my efforts. So this line must always be the first one in the program.

Listing 3 shows the machine code, which is POKEd and executed. To change the line number jumped to on Break, change the 1 and 4 which occur after the 204 in line 100. In standard 6809 format, this is ("1" * 256 + "4") to give 260 in this example.

Incidentally, both Model 4 and Color Computer Basic programs just run a demonstration program which counts from 1 to infinity. As soon as you hit Break, the count is reset to 1 to show that the Break was actually intercepted.

As I have made this so easy, see if you can work out how to Break out of the program. I have left a window through which it is still possible for a normal Break to occur, but an application user is unlikely to find it. The change required in the machine code to seal this route of escape is dead easy, and I'll leave it as a puzzle to see if you can find it.

Finally, those Tandy performance figures, which I read in *Computer Retail News*, are in Table 1. Draw your own conclusions, but I must say I find them reassuring considering that miserable 1984. ■



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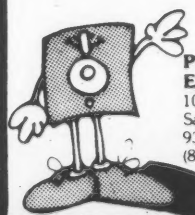

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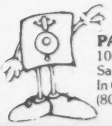

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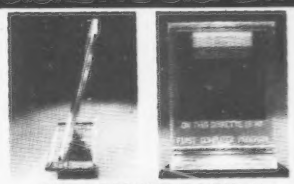

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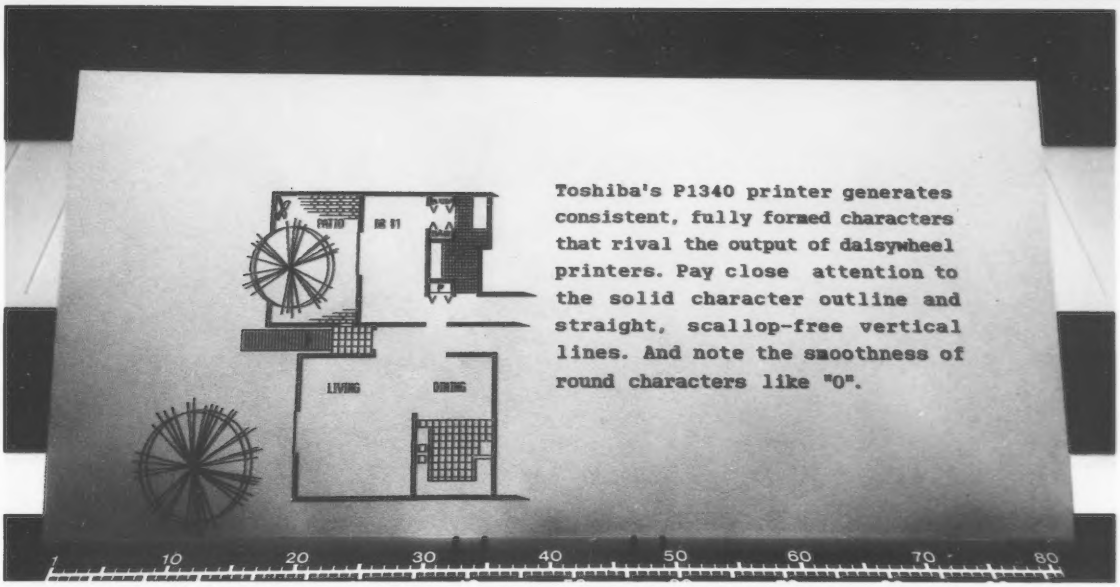

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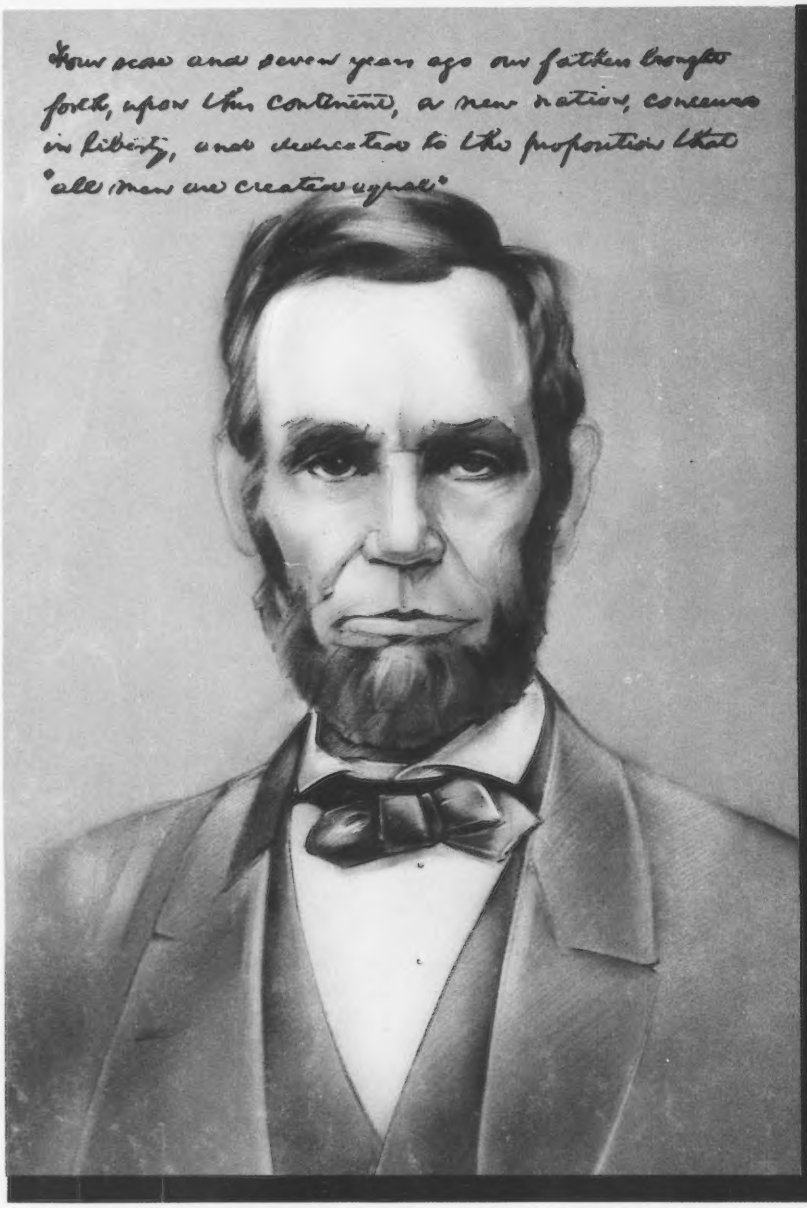
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